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HANDBOOK OF THE  
3-INCH GUN MATÉRIEL

MODEL OF 1902

WITH

INSTRUCTIONS FOR ITS CARE

(THIRTY-THREE PLATES)

AUGUST 1, 1905

REVISED MAY 10, 1906

REVISED JULY 17, 1908

REVISED JULY 1, 1911

REVISED JUNE 24, 1912

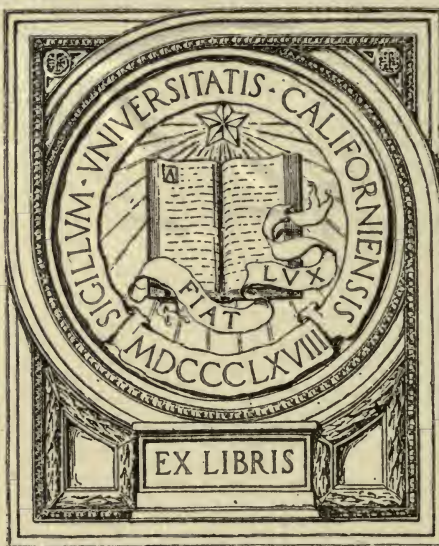
REVISED AUGUST 3, 1915

REVISED JUNE 5, 1917

WASHINGTON  
GOVERNMENT PRINTING OFFICE

1917

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GO WITH!  
AMSTERDAM

WAR DEPARTMENT,  
OFFICE OF THE CHIEF OF ORDNANCE,  
*Washington, June 5, 1917.*

This manual is published for the information and government of the Regular Army and National Guard of the United States.

By order of the Secretary of War :

WILLIAM CROZIER,  
*Brigadier General, Chief of Ordnance.*

(3)



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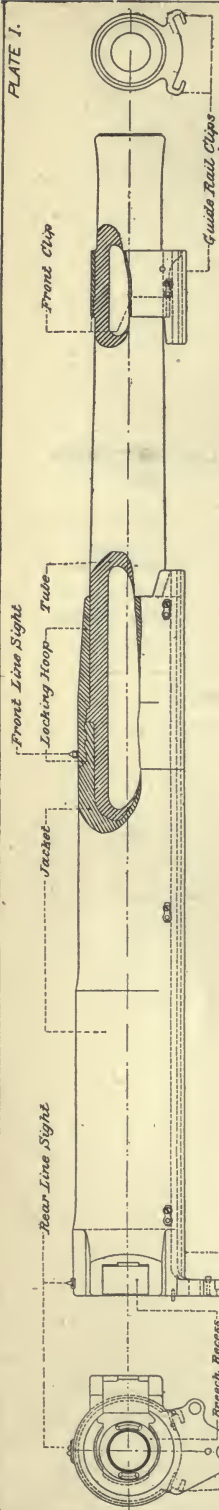




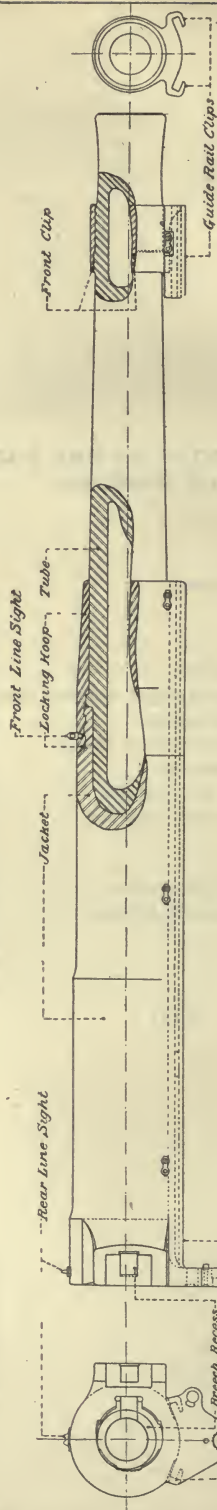


**LIST OF EQUIPMENT PERTAINING TO ONE 3-INCH GUN BATTERY  
ON WAR FOOTING.**

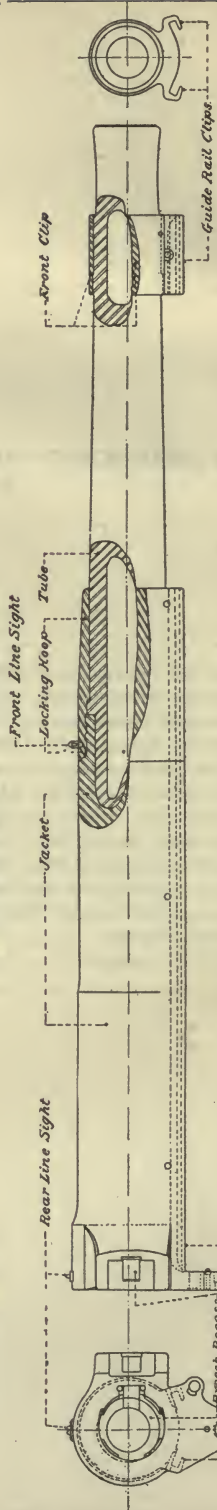
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		Class.	Section.
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3 Inch Field Gun Model of 1902



3 Inch Field Gun Model of 1904



3 Inch Field Gun Model of 1905

Scale 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Inches

# HANDBOOK OF THE 3-INCH GUN MATÉRIEL.

## THE 3-INCH FIELD GUNS, MODELS OF 1902, 1904, AND 1905.

### WEIGHTS, DIMENSIONS, ETC.

#### Weight:

Models of 1902 and 1904	pounds	835
Model of 1905	do	788
Caliber	inches	3
Total length	do	87.8
Length of bore	do	84
Length of rifled portion of bore	do	72.72

#### Rifling:

Number of grooves		24
Width of grooves	inch	0.2927
Depth of grooves	do	0.03
Width of lands	do	0.1

Twist, right-hand	{	Models of 1902 and 1904: 1 turn in 50 calibers at origin to 1 turn in 25 calibers at 12.52 inches from muzzle, thence uniform.
		Model of 1905: 0 turns at origin to 1 turn in 25 calibers at 9.72 inches from muzzle, thence uniform.

Weight of projectile, filled and fuze	pounds	15
Weight of cartridge case	do	2.25
Weight of fixed ammunition (1 round)	do	18.75
Capacity of cartridge case	cubic inches	66.5
Muzzle velocity	feet per second	1,700
Maximum pressure per square inch	pounds	33,000
Range at 15° elevation	yards	6,000
Maximum range, about	do	8,500

### DESCRIPTION OF THE 3-INCH FIELD GUN, MODEL OF 1902.

[Plate I.]

The gun is built up of nickel steel, consisting of a tube, jacket, locking hoop, and clip. The jacket envelops the rear portion of the tube and projects beyond it to form the breech recess or seat for the breech mechanism. A lug, known as the "recoil lug," projects from the under surface of the jacket at its extreme rear end and affords a point of attachment for the recoil cylinder of the carriage. The locking hoop is shrunk on the tube and forward end of the jacket and secures the latter against rearward movement on the tube under



firing stresses. The clip is a short hoop shrunk on the tube near the muzzle.

On the underside of the gun, extending the entire length of the jacket, locking hoop, and clip, are formed two recoil guides or clips, which fit over and secure the gun to the guide rails of the cradle. When the gun is assembled upon the carriage, that portion of the cradle rails between the locking hoop and clip is covered by a sheet-steel dust guard, so that the bearing surfaces of the recoil clips and guide rails are thoroughly protected from dust and dirt. Eight oil holes, closed by handy oilers, are provided for oiling the guide rails of the carriage.

*Nomenclature of breech mechanism for the model of 1902 gun.*

Number.	Name of part.	Location.	Property classification.	
			Class.	Section.
1	Breechblock.....	Front end of block.....	IV	3
1	Breechblock bushing.....	Rear end of block.....		
1	Breechblock cover.....	Screwed into front face of carrier.....		
1	Breechblock stop.....	Secure cover to block.....		
2	Cover locking pins.....	Hinged to jacket; supports block.....		
1	Block carrier.....	Hinges carrier to jacket.....		
1	Hinge pin.....	In hinge pin.....		
1	Hinge-pin catch.....	In recess in carrier.....		
1	Latch bolt.....	Around latch bolt.....		
1	Latch-bolt spring.....	In axial hole through block.....		
1	Firing pin.....	Around firing pin.....		
1	Firing-pin spring.....	Screwed on rear end of firing pin.....		
1	Cap.....	Seated between block and cover.....		
1	Cocking lever.....	In recess in block.....		
1	Sear.....	do.....		
1	Sear spring.....	In seat in block carrier.....		
1	Trigger.....	do.....		
1	Trigger spring.....	Mounted on trigger-arm sleeve.....		
1	Trigger arm.....	In bearing in recoil lug.....		
1	Trigger-arm sleeve.....	Secures trigger arm to trigger-arm sleeve.....		
1	Split pin, taper.....	Pivoted on block carrier.....		
1	Operating lever.....	Pivots lever on block carrier.....		
1	Operating-lever pivot.....	Secures pivot in seat.....		
1	Lever-pivot key.....	In operating lever.....		
1	Lever latch.....	Screwed into rear face of carrier.....		
1	Lever-latch catch.....	Secures latch to lever.....		
1	Lever-latch pin.....	In recess in spring seat.....		
1	Lever-latch spring.....	In breech recess.....		
1	Extractor.....	Mounted on hinge pin.....		
1	Extractor lever.....	Secured to block carrier.....		
1	Operating-lever guide.....	Fasten guide to block carrier.....		
2	Lever-guide screws, 1 long, 1 short.....	Screwed into operating lever.....		
1	Spring seat.....	Seated in recoil lug.....		
1	Cylinder locking stud.....			

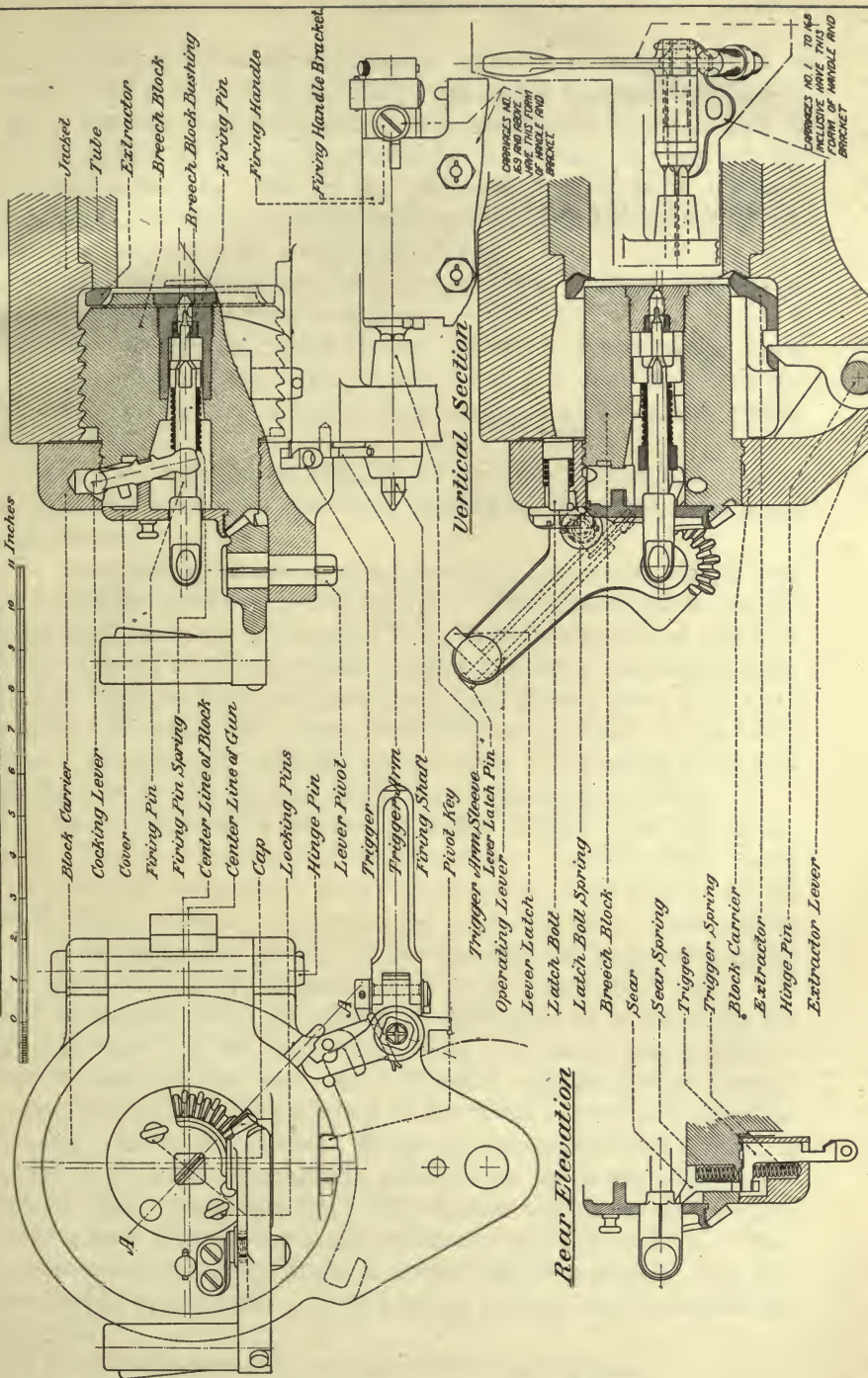
DESCRIPTION OF THE BREECH MECHANISM FOR THE MODEL OF 1902 GUN.

[Plate II.]

The breechblock is of the interrupted-screw type. It has two threaded and two flatted sectors, in rear of which is a cylindrical section, smaller in diameter, on which is a square screw thread for securing the block to the block carrier. The breech recess of the gun is threaded and slotted to correspond with the threads on the block. The latter is bored out axially to form a seat for the firing pin. The

# 3 Inch Field Gun, Model of 1902. Breech Mechanism Assembled.

0 1 2 3 4 5 6 7 8 9 10 Inches







front of this axial hole is closed by the breechblock housing, which is screwed into position and held by a set screw through the breechblock. The rear end is closed by the breechblock cover, which is held by means of undercut grooves in the block and lugs on the cover and locked in place by the two cover-locking pins. A hole through the breechblock and breechblock bushing affords a vent for any gases escaping from a ruptured primer.

For repairing worn breechblock bushings, another bushing is inserted in the end of the present one.

The block carrier is hinged on the right side of the breech recess by the hinge pin, the carrier is bored out and threaded, and the breechblock rotates and is held in this opening by the square threads mentioned above.

A stop for limiting the rotation of the breechblock when in its open position is fitted in a suitable position on the front face of the block carrier.

The latch bolt is located in a seat bored in the carrier and is constantly pressed forward by its spring. When the block is rotated so that its threads are disengaged from those in the gun, a recess in the rear face of the block comes opposite the front end of the latch bolt, and when the block and carrier are swung away from the breech the latch bolt enters this recess, thus locking the block to the block carrier. The block is unlocked by the latch bolt coming in contact with the rear face of the gun in the act of closing the breech.

The operating lever is pivoted on a seat formed by a lug on the carrier. The lever has a handle on its outer end and bevel-gear teeth on its pivot end which mesh with corresponding teeth formed on the rear of the face block. A lug on the operating lever prevents the shock of stopping the rotation of the breechblock from being taken up on the last tooth of the bevel gear on the operating lever.

The lever latch, with its spring, is assembled in a recess in the operating lever by the latch pin; when the breech mechanism is closed the catch on the inner end of the latch engages a catch formed on a lug screwed into the rear face of the block carrier and locks the operating lever to the carrier. When the operating-lever handle is grasped to open the breechblock, pressure on the lever latch disengages its catch from this lug. The spring seat is secured to the operating lever by screwing it into its seat with a teat wrench. After it is once screwed tightly home it should not be removed. The top of the spring seat affords a hard bearing surface for the operating lever guide.

The lever catch spring is assembled in the spring seat.

The operating-lever guide is a strong spring fastened by two screws—one long and one short—to the rear face of the block carrier and prevents any upward movement of the operating lever which

might unlatch it from the block carrier when the battery is moving over rough terrain.

The firing pin has guide lugs near its front end which run in slots in the breechblock bushing. The point of the firing pin projects through a hole in the center of this bushing when the gun is fired. A cap, having a square cross section, is screwed on the rear end of the firing pin and passes through a square hole in the cover; its rear end terminates in a ring for recocking the firing mechanism by hand without opening the breechblock. A shoulder on the cap forms a catch for the sear.

The firing pin is eccentrically located in the block; in the firing position it is in alignment with the axis of the gun and in line with the percussion primer of the cartridge. As the block is rotated to open the breech the pin is moved to one side clear of the primer and remains in that relative position until the block is again rotated in closing the breech.

The cocking lever has a ball-and-socket bearing in the block carrier; the other end of the lever is U-shaped, the forks straddling the firing pin. The middle part of the cocking lever works on cam surfaces on the rear face of the breechblock and on the front face of the cover. The front face of the cocking lever has two lugs or ribs which support it on the cam of the block; its rear face is provided with a stud or pin, which serves to prevent its improper assemblage.

The firing-pin spring is assembled around the firing pin, with its rear end bearing against the forks of the cocking lever and its front end against the guides on the pin.

The sear works in a slot in the breechblock and is held against the cap on the firing pin by a sear spring.

The trigger works in a slot in the block carrier and is urged upward by the trigger spring. As the block is rotated in being closed the trigger engages with the sear, and by pulling on the trigger the gun is fired. When the block is unlocked the trigger is disengaged from the sear and the gun can not be fired.

The trigger-arm sleeve is seated in a bearing in the right side of the recoil lug on the gun; it is provided with a central hole, the forward part of which is square and is flared, and into which the rear end of a square firing shaft, attached to the cradle of the carriage, enters when the gun is in battery. The trigger arm is mounted on the rear end of the sleeve, and its free end engages a notch in the outer end of the trigger. Revolving the firing shaft rotates the sleeve, the trigger arms thus pulling the trigger and firing the piece.

The extractor is ring shaped, with two lips which engage on opposite sides under the rim of the cartridge case. It has two guides on the right side sliding in grooves in the breech recess, and in the web connecting these guides is a beveled slot in which the wedge-shaped end of the extractor lever works.



The extractor lever is cam shaped, is pivoted on the hinge pin, and bears against the rear face of the slot in the gun. It is operated by the block carrier first coming into contact with its outside cam surface and then with its short arm as the block is opened. The hinge-pin hole in the extractor lever is elongated and of such shape as to cause the lever first to act as a wedge on the extractor and then to move it quickly to the rear.

#### ACTION OF THE MECHANISM.

The following movements take place when the breech mechanism is opened: The first  $117^\circ$  motion of the operating-lever handle rotates the block until the threaded sectors are disengaged. The next  $90^\circ$  motion swings the block and block carrier (the two being locked together by the latch bolt) around the hinge pin, leaving the breech-block clear of the recess and its axis at right angles to that of the gun. As the block is rotated about its axis, the pitch of the threads forces the breechblock to the rear and at the same time the cam surface on the rear face of the breechblock forces the cocking lever to the rear, thereby retracting the firing-pin point within the breechblock, in which position the firing pin is held by the sear. It will be noted that the firing-pin spring is compressed as the block is closed. The firing pin should be released from the sear when the gun is not in use. As the block carrier swings around the hinge pin it first causes the extractor lever to move toward the axis of the gun and start the cartridge case from its seat by its wedge action on the extractor; later the block carrier strikes against the short arm of the extractor lever, causing the extractor to move sharply to the rear and thus ejecting the cartridge case from the gun.

When the breech mechanism is closed the following movements take place: In the first  $90^\circ$  motion the block and block carrier swing around the hinge pin, releasing the block carrier from contact with the extractor lever, which leaves the extractor free to be moved forward by the breechblock and cartridge case. As the carrier comes into contact with the face of the breech the latch bolt is forced to the rear, unlocking the block from the carrier. During the last  $117^\circ$  motion of the operating lever the bevel gears rotate the breechblock until its threaded sectors are engaged with those in the breech recess. At the end of this  $117^\circ$  swing the operating lever is locked to the gun by the lever latch. As the block is rotated about its axis the pitch of the interrupted screw threads forces it slightly to the front, finally seating the cartridge in the chamber. During the rotation of the block around its axis the cam surface on the cover forces the cocking lever forward, thereby compressing the firing-pin spring. When the rotation of the block is completed this compression is a maximum. The gun may be fired either by a lanyard attached to the trigger or by means of a firing handle on the cradle.

If the sear fails to trip and release the firing pin, thus causing a misfire, the operating lever should be revolved equal to one tooth of the gear and then closed. This will bring into engagement the trigger and sear and allow the proper action of the mechanism.

The above condition or misfire can be produced by keeping a tension on the trigger while the block is being rotated to the closed position.

#### TO DISMOUNT AND TO ASSEMBLE PARTS OF THE BREECH MECHANISM.

No tools are required for these operations except, possibly, a hook for removing the cover locking pins. The lanyard hook can be used for this purpose. In general, the different parts are easily assembled by hand, and no forcing is required and none should be permitted. No part of the mechanism should be struck directly with a hammer. In case it is found necessary to use force (as, for example, to remove the lever latch pin) a copper drift or a piece of wood should be interposed between the part and the hammer.

To remove the cover: Remove the cover locking pins by pulling them directly to the rear; open the breech of gun; slip cover from its seat.

To assemble the cover: Open the breech of gun; slip the cover into its seat on the rear face of block; insert cover locking pins into the locking-pin holes, forcing the pins directly to the front through the cover into the block.

To remove the cap, firing pin, firing-pin spring, cocking lever, sear, and sear spring: Remove cover as above; rotate block partly to its closed or locked position; unscrew cap; cocking lever, firing-pin spring, firing pin, sear, and sear spring may now be removed in the order named.

To assemble the above-named parts: Rotate the breechblock to a position midway between its open and closed positions; insert in their seats in the order named the sear spring, sear, firing pin with firing-pin spring assembled on it, cocking lever (with stud pin to the rear), and finally screw the cap home on the end of the firing pin until the cylindrical pin on the rear end of the pin is flush with the hole in the body of the cap, rotate the block to the unlocked or open position and assemble cover.

To dismount the operating lever: Remove the cover and unscrew the cap as above; remove lever-pivot key and lever pivot; operating lever may be now lifted from its seat.

To assemble the operating lever: Remove cover and cap as above; place operating lever on its seat with gear teeth meshing correctly with those on block; insert lever pivot and lever-pivot key; assemble cap and cover as described above.

To dismount the lever latch: Remove the lever latch pin by pulling or shoving it from its seat. The latch and latch spring may now be



removed from the lever. The lever latch and spring are assembled by placing them in their seats in the lever and then inserting the lever latch pin. The latter is a straight pin, split at its inner end to hold it in its seat.

To dismount the trigger: Remove cover and small parts of firing mechanism; open the breech and remove the operating lever; press the latch bolt against the face of the carrier and rotate the breechblock by hand past its closed position; after one and one-half revolutions of the block, the trigger will be free and may be lifted from its seat. The trigger spring is also free and may be removed.

To assemble the trigger and trigger spring: The operating lever and small parts of mechanism are supposed to be dismounted. Unscrew the breechblock from the carrier until the trigger spring and trigger can be slipped from the bore of the carrier into their seats; place them in position, and by means of a lanyard hold the trigger outward against its spring in order to prevent burring or injury to the breechblock as the latter is screwed into the block carrier; screw block into carrier and assemble operating lever and small parts of mechanism as described above.

To dismount the breechblock: Remove cover and small parts of mechanism; dismount operating lever; press latch bolt against face of carrier and unscrew breechblock from the block carrier (approximately 1.66 turns of block are required to unscrew it).

To assemble the breechblock to the block carrier: Screw the block into the carrier, assembling trigger spring and trigger.

To dismount latch bolt and spring: Open the breech of gun, press the latch bolt into the carrier far enough to unlock the block, and rotate the latter in the block carrier to its closed position. Press the latch bolt into the block carrier until the lug on the rear end of the bolt clears the rear face of the carrier; now revolve the bolt  $180^\circ$  on its axis and release it. Its spring will force it forward out of its seat.

To assemble the latch bolt and spring: With the breech open, rotate the block in the block carrier to its closed position; put the latch bolt (with spring assembled) in its seat in the carrier; press it back against its spring until the lug on the rear end of the bolt clears the rear face of the block carrier, and then revolve the latch bolt  $180^\circ$  on its axis. Remove the pressure and the bolt will assume its proper position.

NOTE.—The latch bolt is an auxiliary and not an absolutely essential part of the breech mechanism, as the gun may be safely fired without it. This should be done only in emergencies. In firing without the latch the breech must be opened and closed slowly and gently to insure the correct sequence of the swinging and rotating motions.

To dismount the block carrier, extractor, and extractor lever: Open the breech of the gun and remove the hinge pin; the carrier, extractor lever, and extractor may now be removed from their seats.

To mount the block carrier, extractor, and extractor lever: Place the extractor in its seat in the breech recess; place the carrier in position with its hinge hole registering with the holes in the hinge lugs of the jacket; place the extractor lever in position with its small end in the slot in the extractor web and its flat side to the front; insert the hinge pin.

To dismount the trigger arm and trigger-arm sleeve: Remove taper split pin from trigger arm; the latter may then be moved to the rear off of the sleeve; shove the piece a few inches from battery; the sleeve may then be slipped to the front from its seat in the recoil lug.

#### CARE OF THE GUN.

After firing, the bore of the gun should be cleaned to remove the residue of smokeless powder, and then oiled. In cleaning, wash the bore with a solution made by dissolving one-half pound of sal soda in 1 gallon of boiling water. After washing with the soda solution, wipe perfectly dry, and then oil the bore with a thin coating of the light slushing oil furnished for the purpose. A slush brush for use in oiling the bore will be issued by the Ordnance Department upon requisition.

The breech mechanism should be kept clean and well oiled. It should be dismounted from time to time for examination and oiled when assembled. To relieve the firing-pin spring of unnecessary strain the firing pin should always be uncocked when the gun is not in use. This applies to guns, model of 1902 only. The spare parts carried in the trail box or in the battery wagon should be well coated with vaseline or heavy oil and each piece then wrapped in paper to prevent the oil from being rubbed off.

#### DESCRIPTION OF THE 3-INCH FIELD GUN, MODEL OF 1904.

[Plate I.]

The 3-inch field gun, model of 1904, uses the same ammunition as the 3-inch field gun, model of 1902, and the guns are practically the same, with the exception of the breech mechanism.

The gun is a built-up construction of nickel steel, and consists of a tube, jacket, locking hoop, and clip hoop, which is shrunk on near the muzzle of the gun.

The locking hoop serves to secure the jacket from any longitudinal movement to the rear, and is joined to the forward end of the jacket by means of a screw thread employing one and one-half turns to set it in place. A shoulder in the hoop bears against a shoulder on the tube. By this means the jacket is held up tight against the shoulder



on the tube. The locking hoop in addition to being screw threaded is put on with a shrinkage. The clip extension on the front end of the locking hoop for guns of this model has been omitted. This makes a different dust guard necessary for these guns.

The clip hoop is put on with a shrinkage; a cylindrical surface having a shoulder formed thereon is formed on the tube near its muzzle, which serves as a seat for the clip. The clip, in addition to being shrunk on, is secured by means of a key at its rear end, on the under surface, and a pin, which is driven in a horizontal position transversely through the hoop near its front end.

The jacket and locking hoop are provided on their lower element with clips made integral thereto, which fit corresponding guide rails on the carriage. These clips serve to guide the gun during recoil as well as to hold it on the carriage.

At the rear end of the jacket and at its lower element a lug is formed, to which the hydraulic cylinder is secured; there is a projection from this lug on the right side, to which is connected the firing device. Along both sides of the gun and clip hoop, handy oilers are provided for oiling the guide rails of the carriage. The gun is provided with the regular cartridge-case chamber, which is connected to the main bore by a short cone.

The rifling is semicubic parabola in form, having an increasing twist, beginning with one turn in 50 calibers and increasing to one turn in 25 calibers, to within 12.52 inches of the muzzle. From this point the twist is uniform—one turn in 25 calibers—to the muzzle.

The firing device consists of a bracket (bolted to the cradle of the carriage), firing handle, handle-return spring, shaft-return spring, firing-handle shaft, pallet shank, pallet, tripping collar, and adjusting screw. The bracket has a cylindrical portion, the cylinder having a central diaphragm or partition. In the rear portion of this cylinder is fitted the shaft-return spring, which acts on the firing-handle shaft—that is, this spring causes the firing-handle shaft to return to its normal position after the sear has been tripped and the gun fired. The firing-handle shaft returns to its normal position, no matter whether the operator releases his tension on the firing handle or not. In the forward portion of the cylinder the handle-return spring is fitted. This spring is employed to hold the firing handle in a horizontal position convenient for firing the gun.

The firing handle is mounted loosely on the forward end of the firing-handle shaft and is connected therewith by means of a tripping collar and latch. The tripping collar is provided with a squared opening which fits over a correspondingly squared end on the forward end of the firing-handle shaft.

The hub of the firing handle is provided with a trip latch so arranged that the latch is in engagement with a notch in the periph-

ery of the tripping collar. By this means the firing handle is temporarily made fast to the firing-handle shaft. By a sufficient downward movement of the firing handle, the lower end of the trip-latch plunger is caused to come in contact with the adjusting screw, which is suitably located in the firing bracket. This engagement between the lower end of the trip-latch plunger and the adjusting screw forces the plunger upward, thus releasing the trip latch and allowing the firing-handle shaft to return to its original or normal position. The firing handle is arranged so that it can be folded back and out of the way for traveling purposes. The handle is hollow and is provided with a plunger, coil spring, and an adjusting or tension plug, which is screwed in or out by means of a screw-driver until the desired tension on the spring is obtained. One end of the plunger bears against a flat surface on the firing-handle hub and the friction produced by the tension of the spring tends to hold the firing handle in either the folded or open position.

The rear end of the firing-handle shaft is square in cross section and tapered to a point at the end. This squared end projects far enough to the rear to pass through the pallet shank, which is revolvably mounted in a projection on the recoil lug of the gun. On the rear end of the pallet shank is mounted the firing pallet, which is held in place by a taper-split pin. It has a projection which engages a projection on the lower end of the trigger shaft, and by pressing downward on the firing handle the following results follow: The firing-handle shaft is rotated, the shaft-return spring is put under additional tension, the pallet shank rotates, with the firing pallet thereon; this in turn rotates the trigger shaft, which by means of the firing-spring sleeve and trigger fork compresses the firing spring until such time that the front end of the firing-spring sleeve trips the sear and releases the firing pin.

#### DESCRIPTION OF THE 3-INCH FIELD GUN, MODEL OF 1905.

[Plate I.]

The 3-inch field gun, model of 1905, is similar to the 1904 model, except that it is about 50 pounds lighter (this is accomplished by a reduction in the outside diameters of the gun), and that the extension of the clips to the rear on the clip hoop have been omitted. This necessitates a special dust guard between the front end of the locking hoop and the rear end of the clip hoop. The rifling in the guns of this model is also different from that in the guns, models of 1902 and 1904. It starts with 0 turns at origin, and increases to 1 turn in 25 calibers at a point 9.72 inches from the muzzle, thence uniform, 1 turn in 25 calibers, to the muzzle. Handy oilers are employed instead of spring covers for oiling the guide rails of the carriage. This gun employs the same ammunition as the 1902 and 1904 models.

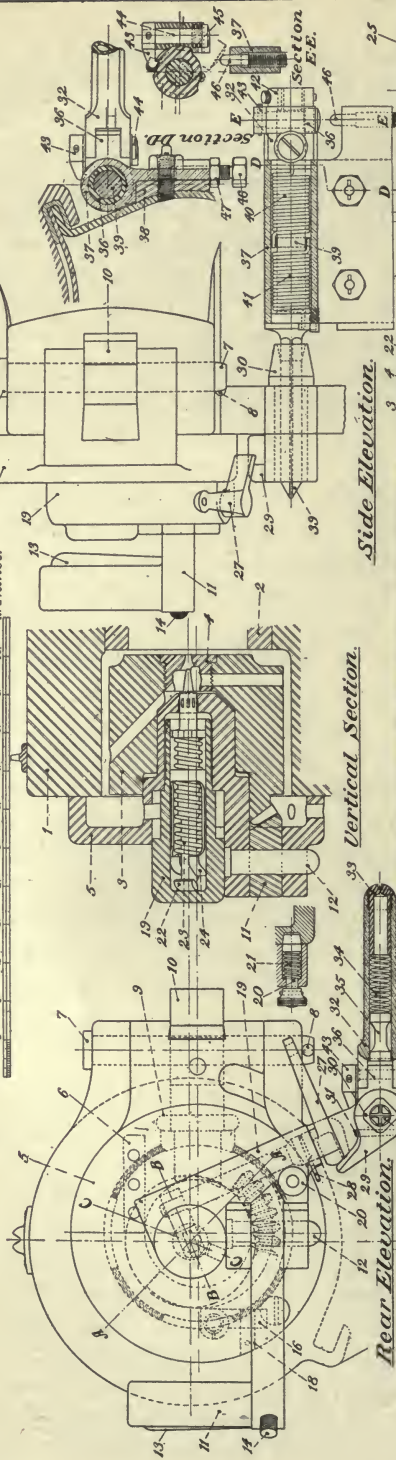




# 3 Inch Field Gun, Models of 1904 & 1905.

## Breech Mechanism Assembled.

0 1 2 3 4 5 6 7 8 9 Inches.

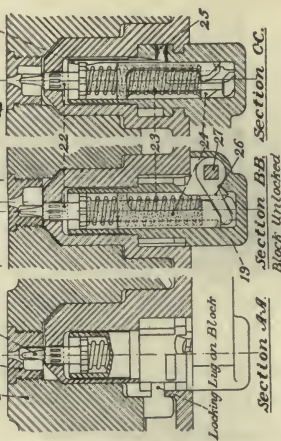


Side Elevation.

Vertical Section.

Rear Elevation.

No.	Name of Part	No.	Name of Part
1	Sight	26	Trigger Fork
2	Table	27	Trigger Shaft
3	Breech Block	28	Trigger Shaft Detent
4	Vent Bushing	29	Firing Pinlet
5	Block Carrier	30	Falset Shank
6	Block Stop	31	Falset Pin
7	Hinge Pin	32	Firing Handle Plug
8	Hinge Pin Catch	33	Firing Handle Spring
9	Extractor	34	Firing Handle Plunger
10	Extractor Lever	35	Firing Handle Hub
11	Operating Lever	36	Firing Handle Bracket
12	Lever Pivot	37	Bracket Seat
13	Lever Latch	38	Firing Handle Shaft
14	Lever Latch Pivot	39	Handle Return Spring
15	Lever Latch Spring	40	Handle Return Spring
16	Block Latch	41	Tripping Collar
17	Block Latch Spring	42	Trip Latch
18	Block Latch Pivot	43	Trip Latch Spring
19	Locking Bolt Case	44	Trip Latch Plunger
20	Locking Bolt Nut & Pin	45	Adjusting Screw
21	Locking Bolt Spring	46	Check Nut
22	Firing Pin	47	Check Nut
23	Firing Pin Spring		
24	Firing Spring Sleeve		
25	Seat		



Section AA Block Unlocked

Section BB Block Locked

Section CC Block Locked

Section DD Block Locked

Horizontal Section.

The breech mechanisms of the guns, models of 1904 and 1905, are similar in every respect and are interchangeable. The breechblock is of the interrupted-screw type, and is provided with four-threaded and four-slotted sectors. The front end of the axial recess in the block for the hub of the block carrier is closed by a bushing. Four ventholes leading from a cavity in the bushing rearwardly through the breechblock permit the escape of gas from a ruptured primer. On a semicircular boss on the rear face of the breechblock are cut gear teeth, in which the gear teeth of the operating lever bevel gear mesh. The upper end of the circular boss on which the gear teeth are cut serves as a stop to limit the rotation of the block in the unlocked position. This upper end of the circular boss comes in contact with a hardened steel stop riveted to the inner face of the block carrier. A radial lug or tooth projects from the inner surface of the circular boss on the breechblock and engages an L-shaped groove cut in the hub of the block carrier, so that when the mechanism is unlocked no relative movement between the breechblock and carrier can take place. In order to surely maintain this relation between the breechblock and block carrier, a block latch, pivoted on the inner face of the carrier in the lower left-hand quadrant, engages a notch or shoulder cut in the rear face of the block adjacent to the circular hub on which the gear teeth are cut. This latch is so pivoted that as the mechanism is swung free from the gun it moves forward sufficiently to engage the notch in the block, and also to cause the forward plane of the latch to project forward of the front face of the block carrier; consequently when the mechanism is swung to the closed position the front face of the latch comes in contact with the rear face of the breech of the gun, thus forcing the latch out of the notch in the breechblock back into a recess in the carrier, and by continuing the motion of closing the mechanism the breechblock is free to rotate on the hub of the carrier and engage its threads with those in the gun. When the breechblock is in the locked position a lug on the firing-lock case engages the front face of the tooth or lug on the breechblock, which locks the breechblock to the carrier. This engagement between the lug on the breechblock and the lug on the firing-lock case serves to lock the carrier to the breechblock and prevent displacement due to a blowback. This is accomplished through the medium of four additional lugs on the firing-lock case, which are arranged to interlock with corresponding lugs on the carrier. The breechblock is mounted eccentrically in the breech of the gun with reference to the axis of the bore, and is concentrically mounted on a hub on the block carrier, in which the firing-lock case is fitted.



The firing-lock case is eccentrically fitted in the hub of the block carrier, in such a position that the axis of the firing pin is always in line with the bore of the gun. The bushing in the front end of the breechblock, through which the firing pin passes, when in the fired position, is fitted eccentrically with reference to the breechblock and the bushing is provided with a cavity of such dimensions that the breechblock is permitted to revolve freely about the firing pin, which is fixed in the hub of the block carrier and does not rotate. The point of the firing pin, when at rest, is always within the enlarged cavity in the bushing, and when the block is revolved to the unlocked position the hole in the bushing through which the point of the firing pin passes is moved to one side, due to the eccentric arrangement of the breechblock, thus masking the point of the pin and preventing any possible contact between the firing pin and the primer in the cartridge case when the block is unlocked. The block will be practically fully locked before any contact between the firing pin and primer can take place. The firing pin is provided with a shoulder a short distance in rear of its forward end, which comes in contact with the rear face of the bushing if an attempt is made to fire the gun when the breech is unlocked. This is done to prevent any possible blow coming on the point of the firing pin and injuring the same.

The firing mechanism belongs to that type known as a continuous-pull mechanism; that is, no cocking of the firing pin is required other than a pull on the lanyard or a downward pressure on the firing handle. This arrangement permits of repetition of the blow from the firing pin in case of a misfire as often as desired without the opening of the mechanism or recocking the firing pin.

#### FIRING PIN.

The firing pin is mounted in the firing-lock case and near its front end is provided with a collar which serves to guide the pin axially and as a shoulder for the front end of firing spring, and also serves as a means for locking the firing pin by the sear until such time that the firing spring has been compressed by the action of the firing mechanism, and the sear released. The rear end of the firing pin is rectangular in cross section and is provided with a double lug against which the trigger fork engages at a point between its upper end and its axis. The engagement serves as a means of withdrawing the firing pin to its retracted or normal position, after the pin has been released and forced forward. Opposite the double lug for the trigger fork the firing pin is provided with another and smaller lug, which fits into a slot in the firing-spring sleeve and serves to hold the sleeve in its proper position.



## FIRING SPRING.

The firing spring is threaded over the firing pin from the rear end of the pin, and over this is assembled the firing-spring sleeve in such a manner that when it is seated in its proper position the firing spring is put under an initial tension by being compressed between the collar on the front end of the firing pin and a shoulder or seat formed on the inside of the sleeve at its rear end. One end of the firing spring is turned up to fit into a hole in the firing-spring sleeve in order to hold the spring at all times in its proper position.

## SEAR.

The sear, which is in the form of a leaf spring, is seated in a slot in the firing-lock case and is provided with a thickened forward end, into which is cut a notch, in which a hardened portion of the periphery of the collar on the firing pin engages. Just to the rear of this notch in the sear an inclined surface is provided, upon which the forward end of the firing-spring sleeve acts in its forward motion to compress the spring and fire the gun. After the sleeve has traveled the required distance forward to produce the proper compression of the firing spring the sear is forced outward, thus releasing the engagement between the sear and the collar on the firing pin. On the rear end of the sear a cylindrical projection is formed, which fits into a hole drilled into the firing-lock case. This serves to hold the sear in place.

## TRIGGER FORK.

The trigger fork is seated in the rear end of the firing-lock case, and is constrained from displacement laterally by the walls of the case, and is mounted on the upper squared end of the trigger shaft. The trigger fork is bifurcated on the end which engages the firing pin and sleeve, and it is seated so that the flat sides of the firing pin pass between the bifurcated end of the fork and the rear face of the bifurcated end bears against the front face of the double lug on the firing pin at a point located between the end of the trigger fork and its axis. This point of contact between the firing pin and trigger fork is important, as it helps to maintain the proper operation of the firing pin in its return action after firing. The extreme bifurcated ends of the trigger fork are made in the form of a circle, and these ends bear against a flat surface on the rear end of the firing-spring sleeve perpendicular to the axis of the sleeve, and do not touch the sleeve at any other point. This is important and is the main element which causes the firing pin to return to its normal position after firing. The firing spring is under tension at all times, and exerts an equal pressure between the collar on the front end of the firing

pin and its seat in the rear end of the firing-spring sleeve. These points of exerted pressure are in a direct line axially, and the pressures are equal; but the point of contact between the bifurcated end of the trigger fork and the rear end of the sleeve being placed at a point outside of the normal line of pressure of the firing spring, the leverage and movements being such that the spring acting on the sleeve, which in turn is acting on the trigger fork, forces the latter to the rear, which in turn carries the firing pin to the rear, through the medium of the double lug on its rear end, against which the trigger fork bears. This action is due to the fact that the lever arm between the outer end of the trigger fork is greater than that between the spring and sleeve, and is simply a case of differential leverage. The firing pin assumes its normal position and is locked in place by the sear and is again ready for action.

#### TRIGGER SHAFT.

The trigger shaft is assembled in a projection which forms a part of the firing-lock case and is held in place by a wire detent. It has at its upper end a squared portion on which the trigger fork is mounted. At its lower end are two projections, the longer of which is provided with a hole for the attachment of a lanyard, by which the gun should be fired until the spade at the end of the trail is sufficiently embedded in the ground to hold the carriage in place. The other projection on the trigger shaft is acted upon by the firing pallet, which is mounted on the pallet shank. The pallet shank is mounted in a bearing in the recoil lug of the gun, and the pallet shank telescopes the firing needle, which is square in section and is mounted in a bracket which is riveted to the cradle. This combination of parts serves as a means for firing the gun from a seat on the carriage.

#### FIRING-LOCK CASE.

The firing-lock case is designed to contain the complete firing gear, and if necessary the entire firing mechanism can be replaced in an instant. It contains the firing pin, firing spring, firing-spring sleeve, sear, trigger fork, and trigger shaft and detent. It is provided with four lugs, by which it is locked in place in the hub of the block carrier, and one lug which is forward of the other four, which engages behind a lug on the breechblock. This lug, together with the other four which lock the case to the carrier, serves to lock the block and carrier together. The firing-lock case is held from displacement due to rotation by a locking bolt. This locking bolt is fitted in a projection of the case and its inner end enters a recess or seat in the rear face of the block carrier.

For the 1904 and 1905 models a firing-lock case stop, consisting of a rivet on the front face of the block carrier, has been provided to prevent an improper assembling of the firing-lock case.

#### OPERATING LEVER.

The handle and body of the lever is recessed to receive the lever latch. The inner end of the lever is provided with beveled gear teeth, which mesh with corresponding teeth on the breechblock and serve as a means for opening and closing the mechanism. The lever is seated between two lugs on the block carrier and is held in place by a pivot.

#### BLOCK CARRIER.

The block carrier is hinged on its right side to the gun by means of the hinge pin. It is provided with a central, inwardly projecting hub, upon which the breechblock is concentrically mounted. The hub is bored out eccentrically to receive the firing-lock case, which is held in place from axial displacement by four lugs formed on the inside of the bore. In the forward end of the central hub a slot is cut which extends to the rear and terminates in an L. This receives the lug on the breechblock and holds the block from displacement when the mechanism is open. Two lugs are formed on the rear face of the carrier just below its center. They form a seat for the operating lever. On the inner face in the lower left-hand quadrant a seat and pivot for the block latch is provided. In the upper right-hand quadrant on the inner face a hardened steel block stop is riveted. This limits the rotation of the block in the open position. On the right side of the block carrier two hinge lugs are provided, between which the extractor lever is mounted. Also between these lugs is fitted a hardened steel pallet, which serves to operate the extractor. In the lower circumference are drilled three ventholes for the escape of gas in case of a blowback. A catch for the lever latch is suitably located and screwed to the rear face of the carrier. It is held in place by a small pin driven in from the circumference of the carrier.

#### BLOCK LATCH.

A recess in the latch contains a spring which presses against the inner face of the carrier, which forces the latch forward into its locking recess in the block, when the breech is open. When the block is locked the latch rests against the rear face of the jacket. The latch serves to prevent rotation of the block to its closed position until it is forced backward by coming in contact with the breech of the gun.



**EXTRACTOR.**

The extractor slides in a groove cut in the breech recess and is operated by the extractor lever, the inner end of which enters a beveled slot in the extractor. A lip on the extractor engages the rim of the cartridge case and serves as a means for ejecting the same.

**EXTRACTOR LEVER.**

The extractor lever is fulcrumed on the hinge pin and bears against the front face of its seat in the gun. A cam formed on its hub is so located that in swinging the carrier to the open position the extractor lever is forced inward, causing a wedging action and loosening the case. At a time near the end of the swinging movement of the carrier the hardened steel pallet on the carrier strikes a short arm on the extractor lever and ejects the case.

**LEVER LATCH.**

The latch is fitted in a seat in the operating lever and serves to lock the handle from rotation, which in turn prevents rotation of the block. The latch is held in place by a long steel pivot, which is so fitted that it is held in place by the lever latch and the action of its spring.

**HINGE PIN.**

This is a hardened steel pin ground to fit, and is held from displacement by a hinge-pin catch fitted to its lower end.

**FIRING PALLET.**

The firing pallet is a steel piece provided with a short lever arm which engages the short arm on the trigger shaft. It is provided with a squared opening for assembling to the end of the pallet shank, and is held in place by the pallet pin driven through its hub tangential to the pallet shank. It is provided with a stud on its forward face, which enters a recess cut in the rear face of the recoil lug on the gun. This serves to hold the pallet and shank in their proper position during the recoil of the gun.

**PALLET SHANK.**

The pallet shank is revolvably mounted in a seat formed in the recoil lug of the gun and is held in place by a head on its forward end and the firing pallet on its rear end. The pallet shank is provided with a square hole which is flared at its forward end to facilitate the engagement between it and the firing needle during the counter-recoil of the gun. This piece serves as the direct connection between the gun and carriage for firing the gun.



## ACTION OF THE BREECH MECHANISM.

To open the breech, grasp the operating lever handle; at the same time compress the level latch handle. This releases the latch from the catch on the block carrier. Rotate the operating lever to the rear. During the first part of this movement ( $67\frac{1}{2}^{\circ}$ ) the block is rotated and its threads disengaged from those of the gun, at which time the stop on the block comes in contact with the stop on the block carrier and the block latch will drop into its notch in the block at the moment of swinging the carrier from the gun. The block is now locked against further rotation in either direction. During a further rotation of the operating lever of about  $90^{\circ}$  the block and carrier swing about the hinge pin clear of the breech recess, the pallet on the carrier forces the extractor lever inward, unseating the cartridge case before the end of the  $90^{\circ}$  movement, and finally ejects the case free of the gun. When another round is inserted the rim of the cartridge case comes in contact with the extractor and forces it partly home. Inclosing the mechanism the movements are simply the reverse of opening; as the block carrier comes in contact with the breech face of the gun, the block latch is forced rearward, unlocking the block from the carrier. Further rotation of the operating lever rotates the breechblock, causing its threads to engage those of the gun. This engagement of threads moves the block forward, due to the pitch of the threads, and firmly seats the cartridge in the gun. At the final motion of the operating lever its latch engages the catch on the rear face of the block carrier, locking the block in the closed position. The gun is now ready to fire.

## TO DISMANTLE THE FIRING MECHANISM.

Take hold of the milled headed locking bolt situated at the lower end of the firing-lock case, pull it to the rear; at the same time revolve the firing-lock case upward about  $45^{\circ}$  and pull it gently to the rear. This will remove the case with the firing mechanism complete from the gun. Press the trigger-shaft detent until it disengages from the notch in the firing-lock case. This will allow the trigger-shaft, with its detent, to be withdrawn. Then gently press on the front end of the firing pin, forcing it back into the casing. This will allow the trigger fork to fall out. Then, with one finger placed on the front end of the sear, force it outward; at the same time grasp the front end of the firing pin, which is roughened for the purpose. Give it a sharp pull. This will remove the firing-pin spring and sleeve from the casing. Then place the front end of the firing pin against a block of wood, bear down on the firing-spring sleeve until the spring is compressed sufficiently to disengage the slot in the rear end of the sleeve

from the small lug on the rear end of the firing pin, slightly turn the sleeve, and then the sleeve can be separated from the spring and pin. By an unscrewing motion the spring can be removed from the pin. The sear can be removed by gently pressing it in toward the center of the casing.

To assemble, reverse these operations, taking care that before driving too hard on the end of the trigger shaft that the square hole in the trigger fork is in position to receive the tapered end of the trigger shaft. No tools are required for assembling or dismantling this mechanism.

#### TO DISMANTLE THE BREECH MECHANISM.

Grasp the operating lever and open the mechanism; when the mechanism is open, force the block latch out of its seat in the block by gently pressing it into its seat in the carrier. Take hold of the block and revolve it to the left until it stops; then pull it to the rear, taking care not to drop it. The block latch can now be readily removed. After the firing-lock case has been removed, the operating lever can be removed by forcing its pivot up from beneath by a gentle pressure from the palm of the hand. The lever latch can be removed by pressing in on the latch at a point near its lower end opposite its pivot; a hole in the latch is cut eccentric with reference to the pivot and a shoulder on the pivot prevents their displacement until the latch is forced in until the hole is concentric with the pivot. When this occurs, the pivot can be readily pulled out and the latch removed. To remove the block carrier, force the hinge pin up by hand until it can be caught by the head, and by swinging the carrier back and forth, if the pin sticks, it can readily be removed, taking care not to drop the extractor lever. The extractor can now be removed from the gun.

Reverse these operations for assembling the mechanism. No tools other than the hands are required for dismantling this breech mechanism.

The models of 1902, 1904, and 1905 guns are interchangeable with the model of 1902 carriage.



## Service range table for 3-inch field guns.

Shrapnel.		Shell.		Shell and shrapnel. <sup>1</sup>										Probability table, 50 per cent zone.					
Range: M. V. = 1,700 f. s.	Range: M. V. = 1,640 f. s.	Angle of depar- ture.	Angle of eleva- tion.	One mil in yards of range.	Time of flight.	Drift.	Deviation, for 10- mile cross wind.	Angle of fall.	Remaining ve- locity.	Danger space for target 5 feet high.	Percussion, shell and shrapnel.			Time shrapnel.					
Yds.	Yds.	Mils.	Mils.		Secs.	Mils.	Mils.	Mils.	F. S.	Yds.	Yds.	Yds.	Yds.	Yds.					
100	98	1.7	0.1	55.6	0.18	0.0	0.0	1.7	1,647.0	993.2									
200	192	3.5	1.8	52.6	.36	.1	.1	3.6	1,595.4	470.2									
300	287	5.4	3.7	50.0	.55	.2	.1	5.7	1,547.0	297.0									
400	383	7.4	5.7	47.6	.75	.3	.2	8.0	1,501.5	212.2									
500	480	9.5	7.8	47.6	.96	.4	.2	10.5	1,458.6	161.8	0.08	0.32	8.3						
600	578	11.6	9.9	45.5	1.17	.4	.3	13.2	1,418.0	129.0									
700	676	13.8	12.1	43.5	1.38	.5	.3	16.0	1,379.5	105.8									
800	775	16.1	14.5	40.0	1.60	.6	.4	19.1	1,343.0	88.7									
900	875	18.6	16.9	40.0	1.83	.7	.4	22.5	1,308.5	75.5									
1,000	976	21.1	19.4	37.0	2.07	.8	.5	26.0	1,275.9	65.3	.40	.61	15.9						
1,100	1,078	23.8	22.1	37.0	2.31	.9	.6	29.7	1,245.2	57.2									
1,200	1,180	26.5	24.8	34.5	2.56	1.0	.7	33.7	1,216.3	50.5									
1,300	1,282	29.4	27.7	34.5	2.81	1.2	.8	37.8	1,189.2	44.8									
1,400	1,384	32.3	30.6	32.3	3.07	1.3	.9	42.2	1,163.8	40.2									
1,500	1,487	35.4	33.7	31.3	3.34	1.5	1.0	46.7	1,140.0	36.3	1.1	1.2	22.8						
1,600	1,590	38.6	36.9	30.3	3.61	1.6	1.1	51.5	1,117.6	33.0									
1,700	1,693	41.9	40.2	29.4	3.89	1.8	1.2	56.5	1,096.4	30.0									
1,800	1,796	45.3	43.6	28.6	4.17	1.9	1.3	61.7	1,076.3	27.5									
1,900	1,898	48.8	47.1	27.8	4.46	2.0	1.4	67.1	1,057.2	25.4									
2,000	2,000	52.4	50.7	27.0	4.75	2.1	1.4	72.6	1,039.0	23.3	2.1	1.5	29.1	2.5	34.5				
2,100	2,101	56.1	54.4	26.3	5.05	2.3	1.5	78.4	1,021.7	21.7									
2,200	2,202	59.9	58.2	26.3	5.35	2.5	1.6	84.3	1,005.3	20.2									
2,300	2,302	63.7	62.0	25.6	5.65	2.7	1.7	90.4	989.8	18.7									
2,400	2,401	67.6	65.9	25.0	5.95	2.9	1.8	96.6	975.2	17.5									
2,500	2,500	71.6	69.9	25.0	6.26	3.1	1.9	103.0	961.5	16.5	3.5	1.9	34.6	3.8	37.2				
2,600	2,599	75.6	73.9	24.4	6.57	3.3	2.0	109.5	948.7	15.5									
2,700	2,698	79.7	77.9	24.4	6.88	3.4	2.0	116.1	936.7	14.5									
2,800	2,797	83.8	82.0	23.8	7.19	3.6	2.1	122.8	925.5	13.8									
2,900	2,896	88.0	86.2	23.3	7.51	3.8	2.2	129.6	915.1	13.0									
3,000	2,995	92.3	90.4	22.7	7.83	4.0	2.3	136.6	905.5	12.3	5.3	2.5	39.4	5.3	39.5				
3,100	3,094	96.7	94.8	22.2	8.15	4.2	2.4	143.7	896.7	11.7									
3,200	3,193	101.2	99.3	22.2	8.47	4.4	2.5	151.0	888.6	11.2									
3,300	3,292	105.7	103.8	21.7	8.80	4.6	2.6	158.4	881.1	10.7									
3,400	3,391	110.3	108.4	20.8	9.13	4.8	2.7	165.9	874.1	10.2									
3,500	3,490	115.1	113.2	20.4	9.47	5.0	2.8	173.6	867.5	9.7	7.5	3.0	44.0	7.2	41.9				
3,600	3,500	120.0	118.1	20.4	9.82	5.2	2.9	181.5	861.2	9.2									
3,700	3,690	124.9	123.0	19.6	10.17	5.4	3.0	189.6	855.1	8.8									
3,800	3,790	130.0	128.1	19.2	10.53	5.7	3.1	197.8	849.1	8.5									
3,900	3,890	135.2	133.3	18.9	10.89	5.9	3.2	206.2	843.1	8.2									
4,000	3,990	140.5	138.5	18.9	11.25	6.1	3.3	214.8	837.2	7.8	10.3	3.4	48.2	8.9	44.1				
4,100	4,080	145.8	143.9	18.2	11.62	6.4	3.4	223.6	831.3	7.5									
4,200	4,190	151.3	149.4	17.9	11.99	6.6	3.5	232.5	825.5	7.2									
4,300	4,290	156.9	154.9	17.9	12.37	6.9	3.6	241.7	819.8	6.8									
4,400	4,390	162.5	160.6	16.9	12.75	7.2	3.7	250.9	814.2	6.6									
4,500	4,490	168.4	166.4	16.9	13.13	7.5	3.8	260.4	808.7	6.3	13.6	4.2	52.0	12.2	46.3				
4,600	4,589	174.3	172.4	16.7	13.52	7.8	3.9	270.1	803.3	6.2									
4,700	4,688	180.3	178.4	16.4	13.92	8.1	4.0	279.9	798.0	5.8									
4,800	4,787	186.4	184.4	16.4	14.32	8.5	4.2	289.9	792.8	5.7									
4,900	4,886	192.5	190.6	15.9	14.72	8.8	4.3	300.0	787.7	5.5									
5,000	4,985	198.8	196.9	15.9	15.12	9.2	4.4	310.3	782.7	5.3	17.3	5.4	55.0	15.1	48.3				
5,100	5,084	205.1	203.2	15.6	15.52	9.5	4.5	320.8	777.8	5.2									
5,200	5,183	211.6	209.6	15.4	15.92	9.9	4.6	331.4	773.0	5.0									
5,300	5,282	218.1	216.2	14.9	16.32	10.2	4.7	342.2	768.3	4.8									
5,400	5,382	224.8	222.8	14.9	16.73	10.6	4.8	353.1	763.8	4.7									
5,500	5,482	231.5	229.5	14.5	17.14	10.9	4.9	364.1	759.5	4.5	21.4	6.9	57.4	18.5	50.0				

<sup>1</sup> This shrapnel was made in accordance with O. O. drawing 75-2-3, the radius of the ogive being 2.93 inches.

## Service range table for 3-inch field guns—Continued.

Shrapnel.	Shell.	Shell and shrapnel.										Probability table, 50 per cent zone.					
		Range: M. V. = 1,700 f. s.	Range: M. V. = 1,640 f. s.	Angle of depar- ture.	Angle of eleva- tion.	One mil in yards of range.	Time of flight.	Drift.	Deviation, for 10- mile cross wind.	Angle of fall.	Remaining ve- locity.	Danger space for target 5 feet high.	Percussion, shell and shrapnel.			Time shrapnel.	
													h.	w.	l.	H.	L.
Yds.	Yds.	Mils.	Mils.				Secs.	Mils.	Mils.	Mils.	F. S.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.
5,600	5,682	238.4	236.4	14.3	17.56	11.3	5.0	375.3	755.4	4.3	.....	.....	.....	.....	.....	.....	.....
5,700	5,682	245.4	243.3	14.1	18.00	11.6	5.1	386.7	751.4	4.2	.....	.....	.....	.....	.....	.....	.....
5,800	5,781	252.5	250.5	13.9	18.44	11.9	5.2	398.2	747.5	4.0	.....	.....	.....	.....	.....	.....	.....
5,900	5,880	259.7	257.6	13.5	18.89	12.2	5.4	409.8	743.7	4.0	.....	.....	.....	.....	.....	.....	.....
6,000	5,979	267.1	264.9	13.3	19.36	12.6	5.5	421.6	740.0	3.8	26.0	8.8	59.2	22.7	51.7	.....	.....
6,100	6,078	274.6	272.4	13.2	19.85	12.9	5.6	433.5	736.4	3.7	.....	.....	.....	.....	.....	.....	.....
6,200	6,177	282.2	280.0	13.0	20.35	13.3	5.7	445.6	732.9	3.5	.....	.....	.....	.....	.....	.....	.....
6,300	6,276	289.9	287.7	12.7	20.86	13.7	5.8	457.9	729.5	3.5	.....	.....	.....	.....	.....	.....	.....
6,400	6,375	297.8	295.6	12.7	21.38	14.1	6.0	470.3	726.2	3.3	.....	.....	.....	.....	.....	.....	.....
6,500	6,474	305.7	303.5	12.2	21.92	14.5	6.1	482.8	723.0	3.2	31.2	11.2	61.0	28.1	53.4	.....	.....
6,600	6,573	313.9	311.6	12.2	22.48	14.9	6.3	495.5	719.9	3.0	.....	.....	.....	.....	.....	.....	.....
6,700	6,672	322.1	319.9	11.9	23.05	15.4	6.4	508.3	716.9	3.0	.....	.....	.....	.....	.....	.....	.....
6,800	6,771	330.5	328.3	11.6	23.63	15.8	6.6	521.3	714.0	2.8	.....	.....	.....	.....	.....	.....	.....
6,900	6,870	339.1	336.8	11.6	24.23	16.3	6.7	534.4	711.2	2.8	.....	.....	.....	.....	.....	.....	.....
7,000	6,970	347.7	345.5	11.4	24.85	16.7	6.9	547.7	708.5	2.7	37.3	14.0	62.3	34.4	55.1	.....	.....
7,100	7,070	356.5	354.3	11.2	25.49	17.2	7.1	561.1	705.8	2.5	.....	.....	.....	.....	.....	.....	.....
7,200	7,170	365.4	363.2	11.1	26.15	17.7	7.2	574.7	703.1	2.5	.....	.....	.....	.....	.....	.....	.....
7,300	7,270	374.4	372.2	10.9	26.83	18.2	7.4	588.4	700.4	2.3	.....	.....	.....	.....	.....	.....	.....
7,400	7,370	383.6	381.4	10.8	27.53	18.7	7.6	602.3	697.7	2.3	.....	.....	.....	.....	.....	.....	.....
7,500	7,470	392.9	390.7	10.6	28.25	19.2	7.8	616.3	695.0	2.2	44.4	17.4	63.6	43.5	56.6	.....	.....
7,600	7,569	402.3	400.1	10.4	29.00	19.8	8.0	630.5	692.3	2.0	.....	.....	.....	.....	.....	.....	.....
7,700	7,668	411.9	409.7	10.3	29.78	20.3	8.2	644.9	689.6	2.0	.....	.....	.....	.....	.....	.....	.....
7,800	7,767	421.6	419.4	10.1	30.59	20.9	8.4	659.5	687.0	2.0	.....	.....	.....	.....	.....	.....	.....
7,900	7,866	431.5	429.2	10.0	31.42	21.4	8.5	674.2	684.5	1.8	.....	.....	.....	.....	.....	.....	.....
8,000	7,965	441.5	439.2	9.9	32.28	22.0	8.7	689.0	682.0	1.8	53.0	21.3	64.7	52.6	57.8	.....	.....
8,100	8,064	451.6	449.3	9.7	33.18	22.6	8.9	704.0	679.5	1.8	.....	.....	.....	.....	.....	.....	.....
8,200	8,163	461.9	459.5	9.6	34.12	23.2	9.1	719.2	677.0	1.7	.....	.....	.....	.....	.....	.....	.....
8,300	8,262	472.3	469.9	9.5	35.10	23.8	9.3	734.6	674.5	1.7	.....	.....	.....	.....	.....	.....	.....
8,400	8,361	482.8	480.4	9.3	36.12	24.4	9.5	750.2	672.0	1.5	.....	.....	.....	.....	.....	.....	.....
8,500	8,460	493.5	491.0	9.2	37.18	25.0	9.7	766.0	669.5	1.5	.....	.....	.....	.....	.....	.....	.....

NOTE.—One "mil" =  $\frac{1}{1000}$  of a quadrant. This corresponds to the graduation of the battery commander's telescope and the deviation scales on the panoramic and open sights, and equals, for variations in height or lateral deviation, approximately  $\frac{1}{1000}$  of the range.

FORT MONROE, VA., Sept. 23, 1904.

Variations in muzzle velocity to be expected at various temperatures of the powder:

Temperature.	M. V. F. S.
30° F.	-48
40°	-40
50°	-31
60°	-19
70°	0
80°	+24
90°	+52
100°	+82



*Complete range table for 3-inch field guns, models of 1902, 1904, and 1905, when fired with shrapnel.*

[M. V.=1,700 f. s.]

Range.	Angle of departure.		Angle of elevation.		One minute, in yards of range.	$\Delta X$ for $\pm 10$ f. s. M. V.		$\Delta X$ for $\Delta C = \pm 1^\circ$ .	$\Delta X$ for wind 10 miles per hour.	Drift.	Deviation for 10 miles cross wind.	Angle of fall.	Slope of fall.	Time of flight.	Terminal velocity.	Maximum ordinate.
Yds.	°	'	°	'	Yds.	Yds.	Yds.	Yds.	Yds.	°	'	1 on—	Sec-onds.	F. S.	Feet.	
100	0	05.9	0	00.2	16.7	1.0	0.2	0.1	0.0	0	05.8	595.9	0.18	1,647.0	0.2	
200	0	11.9	0	06.2	15.6	1.9	0.8	.2	.0	0	12.2	282.1	.36	1,595.4	.8	
300	0	18.3	0	12.6	14.9	2.8	1.7	.3	.1	0	19.3	178.2	.55	1,547.0	1.7	
400	0	25.0	0	19.3	14.3	3.7	3.0	.5	.1	0	27.0	127.3	.75	1,501.5	2.9	
500	0	32.0	0	26.3	13.9	4.6	4.6	.7	.2	0	35.4	97.1	.96	1,458.6	4.4	
600	0	39.2	0	33.5	13.3	5.5	6.5	1.0	.3	.2	0	44.4	77.4	1.17	1,418.0	6.2
700	0	46.7	0	41.0	12.8	6.4	8.7	1.3	.4	.3	0	54.1	63.5	1.38	1,379.5	8.3
800	0	54.5	0	48.8	12.2	7.3	11.2	1.7	.5	.3	1	04.6	53.2	1.60	1,343.0	10.8
900	1	02.7	0	57.0	11.6	8.1	14.0	2.2	.7	.4	1	15.8	45.3	1.83	1,308.5	13.8
1,000	1	11.3	1	05.6	11.2	8.8	17.1	2.8	.8	.5	1	27.7	39.2	2.07	1,275.9	17.3
1,100	1	20.2	1	14.5	10.8	9.5	20.5	3.5	1.0	.6	1	40.3	34.3	2.31	1,245.2	21.4
1,200	1	29.5	1	23.8	10.4	10.2	24.1	4.3	1.2	.8	1	53.6	30.3	2.56	1,216.3	26.2
1,300	1	39.1	1	33.4	10.0	10.8	27.9	5.2	1.5	1.0	2	07.6	26.9	2.81	1,189.2	31.7
1,400	1	49.1	1	43.4	9.6	11.4	31.9	6.1	1.8	1.2	2	22.3	24.1	3.07	1,163.8	38.0
1,500	1	59.5	1	53.8	9.3	12.1	36.1	7.1	2.2	1.4	2	37.7	21.8	3.34	1,140.0	45.1
1,600	2	10.3	2	04.6	9.0	12.7	40.4	8.2	2.6	1.7	2	53.8	19.8	3.61	1,117.6	53.0
1,700	2	21.5	2	15.8	8.7	13.3	44.8	9.4	3.0	2.0	3	10.6	18.0	3.89	1,096.4	61.8
1,800	2	33.0	2	27.3	8.5	13.9	49.3	10.7	3.4	2.3	3	28.1	16.5	4.17	1,076.3	71.4
1,900	2	44.8	2	39.1	8.3	14.5	53.8	12.1	3.8	2.6	3	46.3	15.2	4.46	1,057.2	81.8
2,000	2	56.9	2	51.2	8.1	15.0	58.3	13.6	4.3	2.9	4	05.1	14.0	4.75	1,035.0	93.1
2,100	3	09.3	3	03.6	7.9	15.5	62.8	15.1	4.9	3.2	4	24.5	13.0	5.05	1,021.7	105.3
2,200	3	22.0	3	16.3	7.7	16.0	67.3	16.7	5.5	3.5	4	44.5	12.1	5.35	1,005.3	118.4
2,300	3	35.0	3	29.3	7.6	16.4	71.8	18.3	6.2	3.9	5	05.0	11.2	5.65	989.8	132.4
2,400	3	48.2	3	42.5	7.5	16.9	76.3	19.9	6.9	4.3	5	26.0	10.5	5.95	975.2	147.3
2,500	4	01.6	3	55.9	7.4	17.3	80.8	21.6	7.7	4.7	5	47.5	9.9	6.26	961.5	163.1
2,600	4	15.2	4	09.4	7.3	17.7	85.3	23.3	8.5	5.1	6	09.4	9.3	6.57	948.7	179.8
2,700	4	28.9	4	23.0	7.2	18.1	89.7	25.0	9.3	5.5	6	31.7	8.7	6.88	936.7	197.5
2,800	4	42.8	4	36.8	7.1	18.5	94.1	26.7	10.2	5.9	6	54.4	8.3	7.19	925.5	216.2
2,900	4	57.0	4	50.9	6.9	18.9	98.5	28.4	11.2	6.4	7	17.5	7.8	7.51	915.1	235.9
3,000	5	11.5	5	05.3	6.8	19.2	102.9	30.1	12.2	6.9	7	41.0	7.4	7.83	905.5	256.6
3,100	5	26.3	5	20.0	6.7	19.5	107.2	31.9	13.2	7.4	8	05.0	7.0	8.15	896.7	278.4
3,200	5	41.4	5	35.0	6.5	19.8	111.5	33.7	14.2	7.9	8	29.5	6.7	8.47	888.6	301.3
3,300	5	56.8	5	50.3	6.4	20.1	115.8	35.6	15.3	8.5	8	54.5	6.4	8.80	881.1	325.4
3,400	6	12.5	6	06.0	6.2	20.4	120.1	37.5	16.4	9.1	9	20.0	6.1	9.13	874.1	350.8
3,500	6	28.6	6	22.1	6.1	20.6	124.4	39.5	17.6	9.7	9	46.0	5.8	9.47	867.5	377.6
3,600	6	45.0	6	38.5	6.0	20.8	128.7	41.5	18.8	10.4	10	12.6	5.5	9.82	861.2	405.9
3,700	7	01.7	6	55.2	5.8	21.0	133.0	43.6	20.1	11.1	10	39.8	5.3	10.17	855.1	435.7
3,800	7	18.8	7	12.3	5.7	21.2	137.3	45.7	21.5	11.8	11	07.6	5.1	10.53	849.1	467.1
3,900	7	36.3	7	29.8	5.6	21.4	141.6	47.9	23.0	12.5	11	36.0	4.9	10.89	843.1	500.1
4,000	7	54.1	7	47.6	5.5	21.6	146.0	50.2	24.5	13.3	12	05.0	4.7	11.25	837.2	534.7
4,100	8	12.2	8	05.7	5.4	21.8	150.5	52.5	26.1	14.1	12	34.6	4.5	11.62	831.3	570.9
4,200	8	30.6	8	24.1	5.3	22.0	155.1	54.9	27.8	14.9	13	04.8	4.3	11.99	825.5	608.8
4,300	8	49.4	8	42.9	5.2	22.2	159.8	57.4	29.6	15.7	13	35.6	4.1	12.37	819.8	648.4
4,400	9	08.6	9	02.1	5.1	22.4	164.6	60.0	31.6	16.5	14	07.0	4.0	12.75	814.2	689.7
4,500	9	28.2	9	21.7	5.0	22.6	169.5	62.7	33.7	17.3	14	39.0	3.8	13.13	808.7	732.7
4,600	9	48.2	9	41.7	4.9	22.8	174.4	65.5	35.9	18.2	15	11.5	3.7	13.52	803.3	777.5
4,700	10	05.9	10	02.0	4.9	23.0	179.4	68.4	38.2	19.1	15	44.6	3.5	13.92	798.0	824.1
4,800	10	29.0	10	22.5	4.8	23.2	184.5	71.3	40.7	20.0	16	18.3	3.4	14.32	792.8	872.5
4,900	10	49.8	10	43.3	4.7	23.4	189.6	74.3	43.3	20.9	16	52.6	3.3	14.72	787.7	922.7
5,000	11	10.9	11	04.4	4.7	23.6	194.7	77.4	46.0	21.9	17	27.4	3.2	15.12	782.7	974.7
5,100	11	32.3	11	25.8	4.6	23.8	199.8	80.5	48.7	22.9	18	02.7	3.1	15.52	777.8	1,028.6
5,200	11	54.0	11	47.5	4.5	24.0	204.9	83.6	51.5	23.9	18	38.5	3.0	15.92	773.0	1,084.4
5,300	12	16.1	12	09.6	4.5	24.2	210.0	86.8	54.3	24.9	19	14.8	2.9	16.32	768.3	1,142.1
5,400	12	38.6	12	32.0	4.4	24.4	215.1	90.0	57.2	25.9	19	51.6	2.8	16.73	763.8	1,201.7
5,500	13	01.4	12	54.7	4.3	24.6	220.2	93.3	60.1	27.0	20	28.9	2.7	17.14	759.5	1,263.2
5,600	13	24.6	13	17.8	4.3	24.8	225.3	96.6	63.1	28.1	21	06.7	2.6	17.56	755.4	1,326.6
5,700	13	48.2	13	41.3	4.2	25.0	230.4	100.0	66.1	29.2	21	45.0	2.5	18.00	751.4	1,391.9
5,800	14	12.2	14	05.2	4.1	25.2	235.5	103.5	69.2	30.4	22	23.8	2.4	18.44	747.5	1,459.1
5,900	14	36.6	14	29.5	4.0	25.3	240.6	107.1	72.3	31.6	23	03.1	2.4	18.89	743.7	1,528.3
6,000	15	01.4	14	54.2	4.0	25.5	245.7	110.8	75.5	32.8	23	42.9	2.3	19.36	740.0	1,599.5

Complete range table for 3-inch field guns, models of 1902, 1904, and 1905, when fired with shrapnel—Continued.

Range.	Angle of departure.		Angle of elevation.		One minute, in yards of range.	$\Delta X$ for $\pm 10$ f. s. $\frac{M}{V}$ .	$\Delta X$ for $\Delta C = \pm 1$ .	$\Delta X$ for wind 10 miles per hour.	Drift.	Deviation for 10 miles cross wind.	Angle of fall.		Slope of fall.	Time of flight.	Terminal velocity.	Maximum ordinate.
<i>Yds.</i>	°	'	°	'		<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	°	'	1 on—	<i>Sec-onds.</i>	<i>F. S.</i>	<i>Feet.</i>
6,100	15	26.7	15	19.4	3.9	25.7	250.8	114.7	78.9	34.1	24	23.2	2.2	19.85	736.4	1,672.8
6,200	15	52.4	15	45.0	3.8	25.8	255.9	118.7	82.5	35.4	25	04.0	2.1	20.35	732.9	1,748.4
6,300	16	18.5	16	11.0	3.8	26.0	261.0	122.8	86.3	36.8	25	45.3	2.1	20.86	729.5	1,826.5
6,400	16	45.0	16	37.5	3.7	26.1	266.1	127.1	90.3	38.3	26	27.1	2.0	21.38	726.2	1,907.2
6,500	17	11.9	17	04.4	3.7	26.2	271.2	131.6	94.4	39.8	27	09.4	1.9	21.92	723.0	1,990.6
6,600	17	39.3	17	31.8	3.6	26.3	276.3	136.2	98.6	41.4	27	52.2	1.8	22.48	719.9	2,076.8
6,700	18	07.2	17	59.7	3.5	26.4	281.4	141.0	102.9	43.0	28	35.5	1.8	23.05	716.9	2,165.8
6,800	18	35.5	18	28.0	3.5	26.6	286.5	146.0	107.4	44.7	29	19.3	1.7	23.63	714.0	2,257.7
6,900	19	04.3	18	56.8	3.4	26.8	291.5	151.2	112.1	46.5	30	03.6	1.7	24.23	711.2	2,352.5
7,000	19	33.5	19	26.0	3.4	26.9	296.5	156.6	117.0	48.3	30	48.4	1.6	24.85	708.5	2,450.2
7,100	20	03.1	19	55.6	3.3	27.1	301.5	162.2	122.1	50.1	31	33.7	1.5	25.49	705.8	2,550.9
7,200	20	33.2	20	25.7	3.3	27.2	306.5	168.0	127.3	52.0	32	19.5	1.5	26.15	703.1	2,654.6
7,300	21	03.7	20	56.2	3.2	27.3	311.5	174.0	132.7	54.0	33	05.8	1.4	26.83	700.4	2,761.4
7,400	21	34.6	21	27.1	3.2	27.5	316.5	180.2	138.3	56.1	33	52.7	1.4	27.53	697.7	2,871.3
7,500	22	06.0	21	58.5	3.1	27.6	321.5	186.6	144.1	58.3	34	40.1	1.3	28.25	695.0	2,984.3
7,600	22	37.9	22	30.3	3.1	27.7	326.5	193.2	150.1	60.5	35	28.1	1.2	29.00	692.3	3,100.5
7,700	23	10.2	23	02.6	3.1	27.8	331.5	200.0	156.3	62.8	36	16.6	1.2	29.78	689.6	3,219.9
7,800	23	43.0	23	35.4	3.0	27.9	336.5	207.0	162.7	65.1	37	05.7	1.2	30.59	687.0	3,342.6
7,900	24	16.3	24	08.7	3.0	28.1	341.5	214.3	169.3	67.5	37	55.3	1.1	31.42	684.5	3,468.6
8,000	24	50.1	24	42.4	2.9	28.2	346.6	221.9	176.2	69.9	38	45.5	1.1	32.28	682.0	3,598.0

On Plate IV, following, are curves with explanation which should facilitate the determination of the initial corrector setting of the fuze setter when abnormal muzzle velocities or atmospheric conditions exist which can be approximately estimated.

### AMMUNITION.

Fixed ammunition is used in the 3-inch field guns, and is made up with either common shrapnel, high-explosive shrapnel, or common steel shell. The rounds as made up vary in length with the type of projectile used. The ammunition chests of the battery are of sufficient size to take any one of the rounds furnished, so that the number of each kind to be carried is a matter for regulation by proper authority. Each round is issued with projectile filled and fuze. The weight of the projectile is 15 pounds, and the total weight of one round is 18.75 pounds. The components of one round are the cartridge case with primer, the powder charge, igniter, projectile, and fuze.

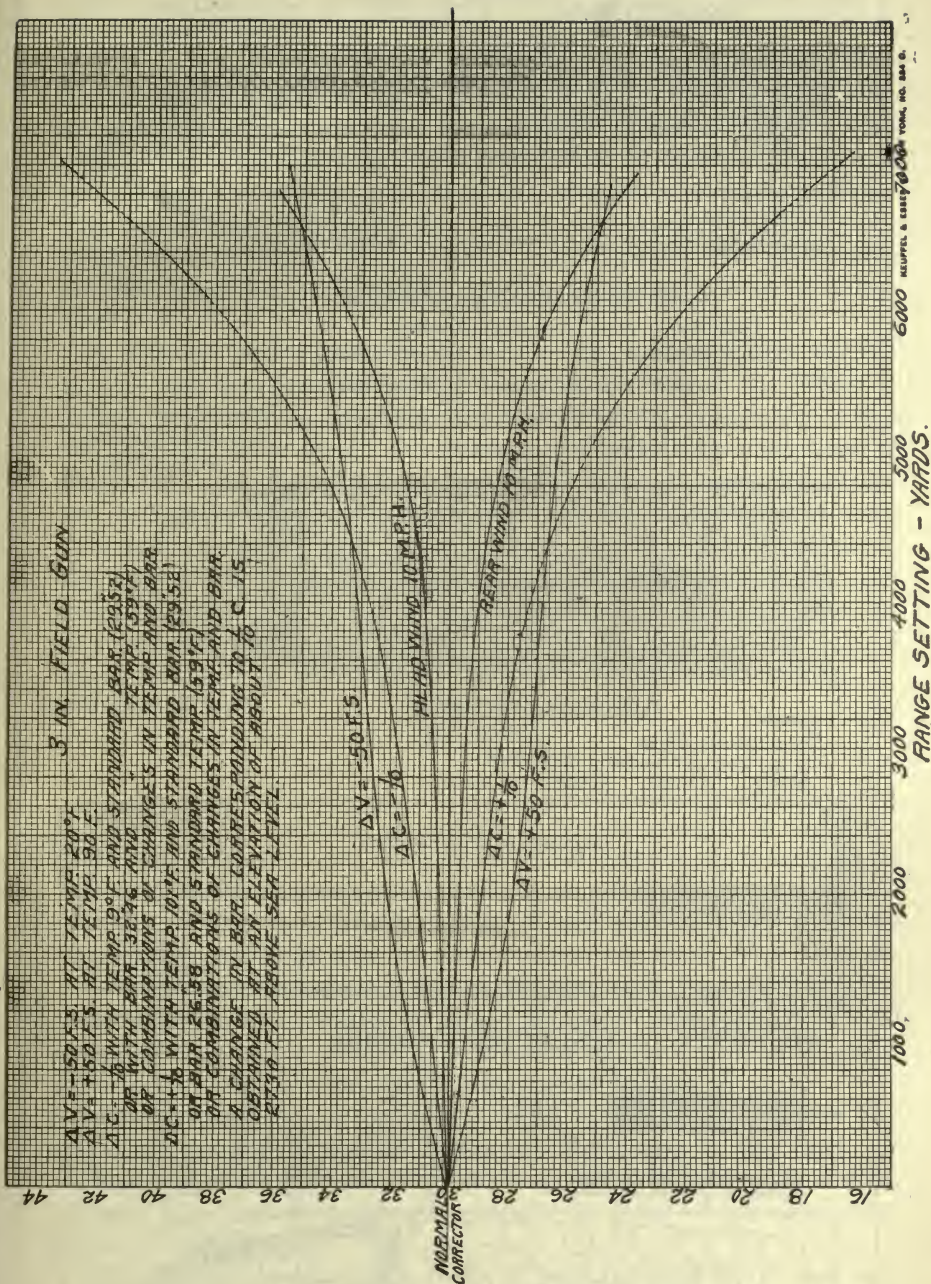
### THE CARTRIDGE CASE.

[Plate V.]

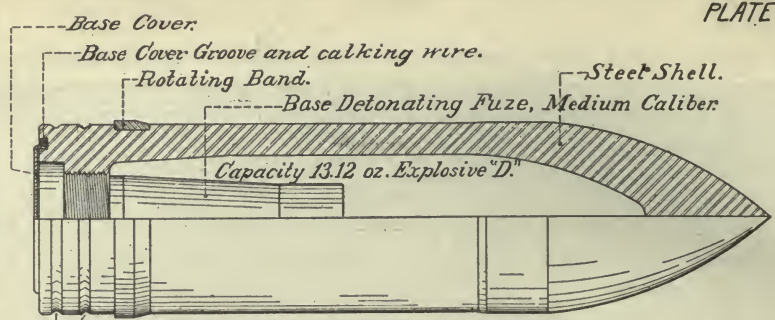
The cartridge case is a solid drawn-brass case 10.8 inches long; it has a capacity of 66.5 cubic inches and weighs, with primer, 2.25 pounds. The head of the case has a projecting flange or rim under



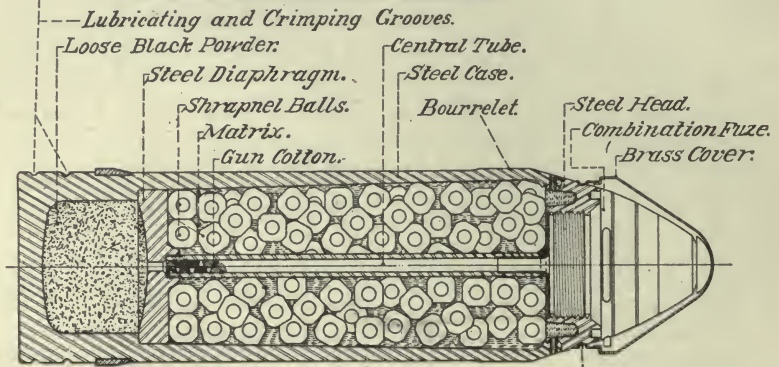
CORRECTOR SETTING REQUIRED TO SECURE NORMAL HEIGHT OF BURST - (FLUE NORMAL)



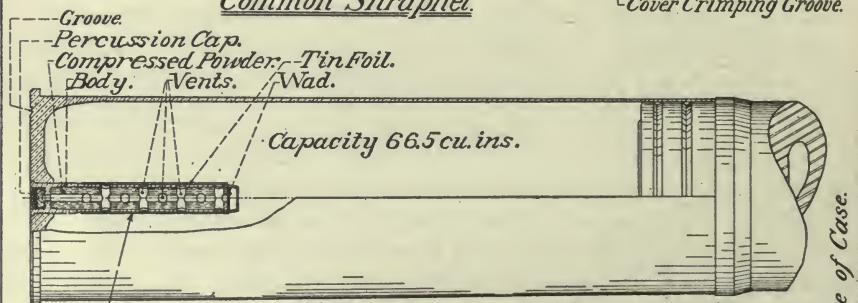




Common Steel Shell.

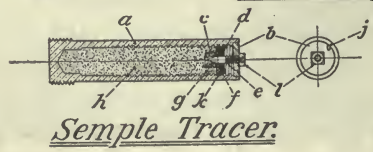


Common Shrapnel.

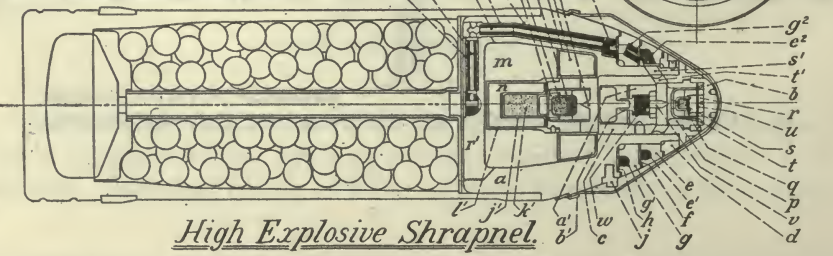


Primer.

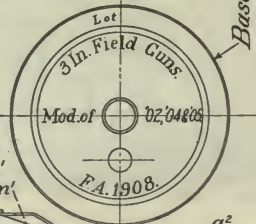
Cartridge Case.



Simple Tracer.



High Explosive Shrapnel.



Base of Case.

which the lip of the extractor engages. The center of the head is bored out to form a seat into which the primer is forced. These primer seats are first mandreled to near the finished dimensions with a tapered steel plug to toughen the metal of the cartridge case around the primer seat and then reamed to finished size. This toughening is necessary to prevent expansion of the seats under gas pressure and consequent loose fit of the primers in subsequent firing. The primers are inserted in the case by the small primer-inserting press to avoid injury to the primer seat. Special decapping tools are also issued for use in removing exploded primers from cartridge cases.

A circular groove is cut in the base of the cartridge case and the groove (on ammunition assembled prior to March 31, 1912) is painted red for shrapnel, black for powder-charged shell, and white for high-explosive shell. For ammunition assembled subsequent to March 31, 1912, the groove is painted red for high-explosive shrapnel, yellow for common shrapnel, and black for high-explosive shell. A circular hole 0.02 inch deep and 0.375 inch diameter is drilled in the base of the cartridge case and filled with red paint for common shrapnel fitted with Semple night tracers and with black paint for day tracers. The base is stamped with the name of gun, initials of place, and year of manufacture, and the ammunition lot number.

#### THE PRIMER.

[Plate V.]

To insure the ignition of smokeless-powder charges in cartridge cases it is necessary that the primers either contain in themselves, in addition to the percussion composition, an auxiliary charge of black powder, or that an auxiliary charge of such powder be placed at the rear of the cartridge case to communicate the flame from the percussion primer and thoroughly ignite the smokeless powder. The percussion primer, known as the "110-grain percussion primer," contains an igniting charge of 110 grains of black powder in addition to the essential elements of a percussion primer.

A second igniting or priming charge, to insure the uniform and complete ignition of the smokeless-powder charge, is also used. It consists of one-fourth ounce of black powder, contained in a disk-shaped bag, placed in the case directly in front of the smokeless-powder charge.

The "110-grain percussion primer" is shown in Plate V and consists of a brass case resembling in shape a small-arms cartridge case. The head or rear end of the primer case is countersunk, forming a cut-shaped recess, in which is seated the cap or percussion primer proper. The latter consists of the cup, the anvil, and the percussion



composition, assembled as shown on Plate V. The percussion composition is known as the "H-42" mixture, and contains the following ingredients:

	Per cent.
Chlorate of potash .....	47.206
Tersulphide of antimony .....	30.829
Flowers of sulphur .....	21.965

The percussion-cap recess is connected with the interior of the primer case by a small vent. The body of the case contains 110 grains of black powder, constituting the rear "priming" or igniting charge for the smokeless powder. This black powder is inserted under a pressure of 36,000 pounds per square inch, and is pressed into the primer body around a central wire, which is then withdrawn, leaving a longitudinal hole the full length of the primer. Eight radial holes are drilled through the primer and compressed powder, affording 16 vents for the free exit of the black-powder flames. After filling the case, the front end is closed by a cardboard wad covered with shellac, and the radial perforations in the body of the case are covered by a tin-foil wrapper to retain in the case any loose black powder, as well as to exclude all moisture.

In action the blow of the firing pin explodes the percussion cap, which ignites the black powder; the flames of the latter shoot out through the vents in the primer case and ignite the smokeless-powder charge.

The primer just described is known as the "110-grain percussion primer," and is used only with smokeless-powder charges. A shorter primer, known as the "saluting primer percussion," is issued by the Ordnance Department for use in blank cartridges. The percussion elements and the dimensions of the seat in the cartridge case for both types of primers are identical. The primer charge of the saluting primer consists of 20 grains of loose rifle powder, held in place by a paper wad shellacked in the mouth of the primer case. The "20-grain saluting primers" are issued in hermetically sealed tin boxes, 25 in a box. The boxes should not be opened nor the cases primed until shortly before they are required for use.

The small primer-inserting press is provided for inserting both types of primers, which must be carefully pressed and not hammered into their seats in the cartridge cases. Special decapping tools are also issued for removing old primer cases from cartridge cases without injury to the latter.

#### THE POWDER CHARGE.

The powder is a nitrocellulose powder composed of multiperforated (7 perforations) cylindrical grains, each 0.35 inch long and 0.195 inch in diameter. The charge varies slightly for different lots of powder, but is approximately 24 ounces. In making up the car-



tridges a packing of paper, felt, or excelsior is placed next to the projectile if necessary to fill the cartridge case, thus holding the powder charge in the rear portion of the cartridge case in contact with the primer. A front igniter of black powder weighing one-fourth ounce is used. The charge gives a muzzle velocity for shrapnel of 1,700 feet per second, with a maximum pressure in the bore not exceeding 33,000 pounds per square inch.

The muzzle velocity of 1,700 feet per second for shrapnel is the standard; for cartridges made up with high-explosive steel shell (and with cast-iron shell when issued) the muzzle velocity, and consequently the powder charge, is so varied as to make the range corresponding to a given elevation as nearly as practicable equal to the shrapnel range for the same elevation. This permits the use of but one range table for all kinds of ammunition and enables the kind of ammunition (type of projectile) to be changed without change of elevation.

Smokeless powder *must not be used* for blank charges. For that purpose the Ordnance Department furnishes special powder for saluting purposes.

#### PROJECTILES.

The projectiles comprise common steel shell, either point or base fuze, and shrapnel, either common or high explosive. A number of cast-iron shell are on hand and will probably be issued for practice until the supply is exhausted.

#### COMMON STEEL SHELL.

The common steel shell is shown in Plate V. It is provided with an ogival head struck with a radius of 2 calibers, and is fitted with a copper rotating band forced into an annular groove 1.2 inches from the base. Between the band and the base are cut two shallow annular grooves, the front one of which is filled with material insuring a waterproof joint in the assembled cartridge; the rear groove is known as the crimping groove. In assembling the ammunition the shell is forced into the cartridge case up to the band, and the metal of the cartridge case is then set into the rear groove at several points, securely fixing the projectile in the case. The base of the shell is tapped for a base detonating fuze and is fitted with a copper base cover secured in the base-cover groove by the calking wire. The base cover consists of a copper cover, lead disk, lying between the cover and the projectile, and a lead calking wire. This base cover seals the joint between fuze and shell against the entrance of powder gases into the shell cavity. The steel shell contains a bursting charge of 13.12 ounces of explosive D. The weight of the shell with bursting charge and fuze is 15 pounds. The shell is always issued filled and fuze.

## COMMON STEEL SHELL, POINT FUZE.

The common steel shell has a large capacity for carrying a considerable quantity of high explosive. It has a capacity of 29.32 cubic inches, sufficient to accommodate approximately 1.42 pounds of the service high explosive. The point-fuzed shell are being modified so as to reduce the weight of high explosives carried to 6½ ounces. The fuzes are also being modified and will be provided with a waterproof hood. This type of shell has been superseded by the base-fuzed common steel shell, and only approximately 7,000 point-fuzed shell remain on hand at this time. The high-explosive shrapnel will eventually replace all types of shell for the 3-inch field gun. The rotating band and the method of assembling the shell to the cartridge case are the same as for the base-fuzed steel shell. It is tapped to take the point detonating fuze. Full instructions as to the manipulation and use of this material in service are issued with it. The weight of the shell, filled and fuzed, is 15 pounds. About 9,000 of these shell have been manufactured. It has been superseded by a base-fuzed steel shell, shown on Plate V.

## COMMON SHRAPNEL.

[Plate V.]

The common shrapnel is a base-charged shrapnel fitted with a combination fuze. The case is of steel with solid base. The rotating band is forced into an annular groove cut in the case 1.2 inches from the base. The front or mouth of the case is closed by a steel head, screwed in and tapped to take the service combination time and percussion fuze. The method of assembling the shrapnel to the cartridge case is the same as that for the common steel shell described above. The bursting charge is composed of a charge of loose black powder (2¾ ounces). The bursting charge, thus arranged, is covered by a steel diaphragm. The diaphragm supports a steel central tube which extends forward to the fuze, and thus affords a conduit for the flames from the fuze to the bursting charge. At the lower end of the central tube a stopper of dry guncotton is fitted to prevent the loose powder charge from getting into the tube and also to help the ignition of the bursting charge. The shrapnel filling is composed of 252 balls, each approximately 167 grains in weight. The balls are approximately 0.5 inch in diameter. The balls are poured around the central tube and rest upon the steel diaphragm, the interstices containing a smoke-producing matrix.

In action the case is not ruptured upon the explosion of the bursting charge; the head is stripped and the balls are shot out of the case with an increase of velocity of about 274 feet per second. The remaining velocity of the shrapnel at 6,500 yards is approximately 724 feet per second, and the time of flight 21.92 seconds, so that at



that extreme range, with the increase of velocity due to the bursting charge, this shrapnel with 21-second fuze is a most efficient projectile. The weight of the shrapnel with fuze is 15 pounds.

#### EHRHARDT HIGH-EXPLOSIVE SHRAPNEL.

[Plate V.]

The Ehrhardt high-explosive shrapnel is fitted with a combination fuze and a high-explosive head. The case is of drawn steel with solid base. The rotating band is forced into an annular groove cut in the case 1.2 inches from the base. The front or mouth of the case is closed by a steel head forced in. The method of assembling the shrapnel to the cartridge case is the same as that for the common steel shell described above. The bursting charge is composed of a charge of loose black powder ( $2\frac{1}{2}$  ounces) and is covered by a steel diaphragm. The diaphragm supports a steel central tube which extends forward to the high-explosive head and thence by a train to the fuze, thus affording a conduit for the flames from the fuze to the bursting charge.

The shrapnel filling is composed of 285 balls each approximately 138 grains in weight. The balls are poured around the central tube and rest upon the steel diaphragm, the interstices containing a matrix of high explosive.

In time action, the case is not ruptured upon the explosion of the bursting charge, but the head is forced out and the balls are shot out of the case with an increase of velocity of from 250 to 300 feet per second. In the meantime the head continues its flight, detonating on impact.

All high-explosive shrapnel ammunition is issued fuzed ready for use.

If the fuze be set at "safety" or for a time of flight greater than the actual time of flight, this shrapnel may be used in lieu of high-explosive shell. Upon impact a high-explosive shrapnel is detonated by means of the percussion element of the combination fuze, the head being detonated first, which detonation causes the sympathetic detonation of the high-explosive matrix surrounding the balls.

#### SEMPLE TRACER.

[Plate V.]

The Semple tracer consists of the following parts assembled as shown in Plate V:

- |                                |                                   |
|--------------------------------|-----------------------------------|
| <i>a.</i> Body, brass.         | <i>g.</i> Priming composition.    |
| <i>b.</i> Plug, steel.         | <i>h.</i> Illuminant composition. |
| <i>c.</i> Cup, brass.          | <i>j.</i> Vent hole in plug.      |
| <i>d.</i> Washer, steel.       | <i>k.</i> Disk, lead.             |
| <i>e.</i> Firing pin, brass.   | <i>l.</i> Nut, brass.             |
| <i>f.</i> Washer, hard rubber. |                                   |



The cavity in body *a* is filled to within about 0.5 inch from top with illuminant composition.

The cup *c* filled with priming composition *g* and firing pin *e* assembled are then placed in position and lead disk *k* forced over illuminant composition and primer.

Plug *b* is then forced in body, after which nut *l* is threaded on end of firing pin.

The interior of the body is threaded to give the illuminant and lead plug a better hold upon the body.

While the projectile is traveling through the bore of the gun, the powder gases enter the vent hole *j* and the pocket beneath the plug *b* becomes filled with gas under pressure. This pressure is sufficient when the projectile reaches or has passed beyond the muzzle of the gun to force out the plug *b*, thereby pulling out the firing pin, which by friction ignites the priming and illuminant composition. The illuminant burns intensely, causing a bright white flame to extend to the rear from the tracer.

## FUZES.

### FRANKFORD ARSENAL COMBINATION FUZES.

These fuzes are point fuzes with combination time and percussion elements for use with common shrapnel. They are of the type known as the ring or "dial" fuze, in which the time train is set by turning a graduated ring which carries part of the time train. These fuzes may be reset as often as desired.

#### EHRHARDT COMBINATION FUZE FOR HIGH EXPLOSIVE SHRAPNEL.

[Plate V.]

The fuze consists of the following parts, assembled as shown on the plate:

- |   |  |
|---|--|
| <i>a.</i> High explosive head, steel.                     | <i>n.</i> Picric acid charge (inner).              |
| <i>b.</i> Closing cap, steel.                             | <i>p.</i> Concussion plunger holder, brass.        |
| <i>c.</i> Plunger sleeve, brass.                          | <i>q.</i> Concussion plunger, brass.               |
| <i>d.</i> Locking ring, aluminum.                         | <i>r.</i> Concussion plunger closing screw, brass. |
| <i>e.</i> Upper time train ring, aluminum.                | <i>s.</i> Concussion primer.                       |
| <i>f.</i> Washer for upper time train ring, felt.         | <i>t.</i> Locking spring, steel.                   |
| <i>g.</i> Graduated time train ring, aluminum.            | <i>u.</i> Safety wire, copper.                     |
| <i>h.</i> Washer for graduated time train ring, aluminum. | <i>v.</i> Concussion firing pin, German silver.    |
| <i>j.</i> Fixed stop pin, steel.                          | <i>w.</i> Safety pellet, compressed powder.        |
| <i>k.</i> Smoke developer hood, pasteboard.               | <i>a'.</i> Filling plug, brass.                    |
| <i>l.</i> Smoke developer.                                | <i>b'.</i> Percussion plunger cap, brass.          |
| <i>m.</i> Picric acid charge (outer).                     | <i>c'.</i> Percussion plunger, brass.              |
|   | <i>d'.</i> Percussion firing pin, nickel.          |

<i>e'</i> . Upper time train, compressed powder.	<i>p'</i> . Flame channel bushing (lower), brass.
<i>f'</i> . Percussion primer.	<i>q'</i> . Bottom closing screw flame channel bushing, brass.
<i>g'</i> . Lower time train compressed powder.	<i>r'</i> . Bottom closing screw, steel.
<i>h'</i> . Percussion plunger closing screw, brass.	<i>s'</i> . } Vents successively leading to
<i>j'</i> . Detonator cup, copper.	<i>t'</i> . } upper time ring.
<i>k'</i> . Fulminate.	<i>u'</i> . Flame channel in high-explosive head.
<i>l'</i> . Capsule, brass.	<i>v'</i> . Flame channel in bottom closing screw.
<i>m'</i> . Flame channel shoulder bushing, brass.	<i>e</i> <sup>2</sup> . Compressed powder pellet in upper time train vent.
<i>n'</i> . Flame channel bushing (upper), brass.	<i>g</i> <sup>2</sup> . Lower time train vent.

The time element of this fuze is composed principally of the following parts:

The time or concussion plunger *q*, the locking spring *t*, the safety wire *u*, the concussion firing pin *v*, the vents *s'* and *t'* leading to upper time train ring; the compressed powder pellet *e*<sup>2</sup>, the upper time train *e'*, the compressed powder pellet *g*<sup>2</sup>, the lower time train *g'* leading to the flame channel in the high-explosive head; thence through the central tube to the base charge.

The concussion plunger *q* is cylindrical in shape, slotted, and rounded at the bottom to fit the locking spring. The former contains the primer in a recess at its base. The weight of the plunger rests upon the locking spring and the safety wire *u*, which keeps the primer from contact with the firing pin. At discharge of the gun the resistance of the locking spring is overcome, the safety wire is sheared off and primer is exploded by contact with the firing pin.

An annular groove in the shape of a horseshoe is milled in the lower face of each of the time train rings, leaving a solid portion between the ends of the groove in each ring. Meal powder is compressed into these grooves forming a time train, the total length of which is 9 inches.

The vents *t'* consist of six holes drilled equal distance from each other connected with each other by a semicircular slot turned on the outside diameter of the plunger sleeve. The vent hole *s'* is drilled through the walls of the high-explosive head and is exactly opposite a hole in the inner surface of the upper time train leading to the end of the train from which the direction of burning is anti-clockwise.

The hole *g*<sup>2</sup> is drilled through the upper face of the lower time train ring *g* to the end of the lower time train from which the direction of burning is clockwise. The lower time train ring is movable and is graduated on its outer edge in a clockwise direction from 0 to 22. Each full division corresponding to one second time of burning in flight; these divisions are subdivided into five equal



parts corresponding to one-fifth second. A radial pin is provided in the lower ring for engagement with a notch in the fuze setter for setting the fuze. A line on the flange of the high explosive head is the datum line for fuze setting.

The action of the fuze as a time fuze is as follows:

Assume the "zero" setting as shown on the figure. At discharge of the gun, the time plunger arms and fires its primer. The flame from the primer passes out through the vents  $t'$  and  $s'$  igniting the pellet  $e^2$ , the end of the upper time train  $e$  down through the vent  $g^2$  to the end of the lower time train  $g$  and thence through the channels  $u'$  and  $v'$  and the central tube to the base charge in the shrapnel.

On time burst, the head is forced out and continues its flight while the balls are scattered. On impact, the percussion plunger  $c'$ , which is now free (the safety pellet  $w$  which holds it having been burned up by the firing of the concussion primer  $s$  on discharge of the gun), is thrown forward, coming in contact with the percussion firing pin  $d'$ , thus igniting the percussion primer  $f'$ . The flame ignites the fulminate  $k'$ , this in turn detonating the inner picric acid charge  $n$  and the outer picric acid charge  $m$ , thus bursting the head.

It will be seen that for the "zero" setting of the fuze the origin of both the upper and lower time train are in juxtaposition.

Assume any other setting, say 12 seconds, the vent  $g^2$  has now changed its position with respect to the vent  $e^2$  leading to the beginning of the upper time train and the channel  $u'$  leading to the base charge, both of which points are fixed by the angle subtended between the 0 and 12 second settings. The flame now passes out through the vents  $t'$  and  $s'$  and burns along the upper time train in anticlockwise direction until the vent  $g^2$  is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the channel  $u'$ , whence it is transmitted to the channel  $v'$  and central tube.

For the 22-second setting the vent  $g^2$  leading to the beginning of the lower time train ring is opposite the end of the upper time train and the end of the lower time train is opposite the channel  $u'$  leading to the base charge. It will now be seen that to reach the base charge and burst the shrapnel the entire length of time train in both rings must be burned.

As already stated, the annular groove in the lower face of each ring for the powder trains do not form complete circles, a solid portion being left between the ends of the grooves in each. This solid portion is utilized to obtain a setting at which the fuze can not be exploded, known as the safety point.

This point is marked by a line on the outer edge of the movable time train, surmounted by an "S," and is located about half way between the zero mark and the 22-second graduation. When this







point is brought opposite the line on the flange of the high explosive head, the vent  $g^2$  is covered by the solid metal between the ends of the upper train and the channel  $u'$  leading to the base charge is covered by the solid metal between the ends of the lower or movable time train.

At the safety setting it may be seen that the upper train may burn entirely out in case of accidental firing of the time plunger or in case it may be desired to burst the shrapnel by impact or percussion, without the flame being able to reach the base charge.

The felt washers  $f$  and  $h$  are glued to the upper face of the graduated time-train ring and to the upper face of the flange on the high explosive head. These surfaces are corrugated, as shown, to make the washers adhere more strongly. The function of the washers is to make a gas check and prevent premature action of the fuzes.

To release the pressure of the gases due to the burning train a vent hole is drilled into the upper and lower time-train ring leading from the end of the train to the outside. These holes are sealed by aluminum disks, but the pressure due to the burning trains immediately opens them.

These fuzes are issued assembled in shrapnel. For transportation in limbers and caissons the fuze should always be set at the safety point.

The fuze is provided with a waterproof hood of thin brass hermetically sealed. The hood must be stripped off before setting the fuze, but should not be moved until the shrapnel is about to be fired.

#### FRANKFORD ARSENAL COMBINATION FUZE, MODEL OF 1907 M.

[Plate VI.]

This fuze consists of the following parts, assembled as shown in the drawing:

- |   |   |
|---|---|
| <p><i>a.</i> Body, bronze.</p> <p><i>a'.</i> Stop pin, brass.</p> <p><i>b.</i> Closing cap, brass.</p> <p><i>b'.</i> Vents in closing cap.</p> <p><i>c.</i> Upper time-train ring, Tobin bronze.</p> <p><i>c'.</i> Washer for time-train ring, graduated, felt cloth.</p> <p><i>d.</i> Time-train ring, graduated, Tobin bronze.</p> <p><i>d'.</i> Washer for body, felt cloth.</p> <p><i>d<sup>2</sup>.</i> Rotating pin, brass.</p> <p><i>e.</i> Concussion plunger.</p> <p><i>e'.</i> Concussion resistance ring, brass.</p> <p><i>f.</i> Firing pin, brass.</p> <p><i>g.</i> Vent leading to upper time train.</p> <p><i>h.</i> Compressed powder pellet.</p> <p><i>i.</i> Upper time train, compressed powder.</p> | <p><i>j.</i> Compressed powder pellet, in vent leading to lower time train.</p> <p><i>j'.</i> Compressed powder pellet in lower time-train vent.</p> <p><i>k.</i> Lower time train, compressed powder.</p> <p><i>l.</i> Brass disk, crimped in place.</p> <p><i>m.</i> Compressed powder pellet in vent <i>c</i>.</p> <p><i>o.</i> Vent leading to magazine.</p> <p><i>p.</i> Powder magazine.</p> <p><i>q.</i> Percussion plunger.</p> <p><i>r.</i> Percussion primer.</p> <p><i>s.</i> Vents leading from percussion primer to magazine.</p> <p><i>u.</i> Bottom closing screw, brass.</p> <p><i>v.</i> Washer for closing screw, muslin.</p> <p><i>w.</i> Washer for closing screw, brass.</p> |
|---|---|



The body *a* of this fuze is machined from a bronze casting. The time-train rings *c* and *d* are turned from hard-rolled rods of Tobin bronze. An annular groove in the shape of a horseshoe is milled in the lower face of each of the time-train rings. Meal powder is compressed into these grooves under a pressure of 66,000 pounds per square inch, forming a time train, the total length of which is 9 inches.

The time element of this fuze is composed principally of the following parts: The time or concussion plunger *e*, the concussion resistance ring *e'*, the firing pin *f*, the vent *g*, leading to the upper time train, the compressed powder pellet *h*, the upper time train *i*, the vent *j*, the lower time train *k*, the compressed powder pellet *m* in the vent *o*, leading to the powder magazine *p*.

The plunger *e* is cylindrical in shape and contains the percussion composition in a recess at its base. The weight of the plunger rests upon the concussion-resistance ring *e'*, which keeps the primer from contact with the firing pin. At discharge of the gun the resistance of the ring is overcome and the primer is exploded by contact with the firing pin.

As stated above, the annular grooves into which the meal powder of the time train is pressed are in the shape of a horseshoe, a solid portion being left between the ends of the groove in each ring or disk.

The upper time-train ring *c* is prevented from rotating by pins which are halved into the fuze body and the inner circumference of the ring.

The vent *g* is drilled through the walls of the concussion-plunger chamber and is exactly opposite a hole in the inner surface of the upper time train leading to the end of the train from which the direction of burning is anticlockwise.

The hole *j* is drilled through the upper face of the lower time-train ring *d* to the end of the lower time-train groove, from which the direction of burning is clockwise. The lower time-train ring is movable and is graduated on its outer edge in a clockwise direction from 0 to 21.2, each full division corresponding to one second time of burning in flight; these divisions are subdivided into five equal parts corresponding to one-fifth second. A radial pin *d<sup>2</sup>* is provided in the lower ring for engagement with a notch in the fuze setter for setting the fuze. A line on the lower flange of the fuze stock is the datum line for fuze settings.

The vent *o* is drilled through the flange of the fuze stock to the powder magazine *p*, and leads to the same end of the lower time train as the vent *j*—that end from which the direction of burning is clockwise—when the fuze is at its “zero” setting.

The action of the fuze as a time fuze is as follows:

Assume first the "zero" setting as shown on the figure. At discharge of the gun the time plunger arms and fires its primer. The flame through the primer passes out through the vent *g*, igniting the pellet *h*, the end of the upper time train *i*, down through the vent *j*, to the end of the lower time train *k*, and thence through the vent *o* to the magazine *p*, the flame from which is transmitted to the base charge in the shrapnel. It will be seen that for the "zero" setting of the fuze the origin of both upper and lower time trains are in juxtaposition. Assume any other setting, say 12 seconds: The vent *j* has now changed its position with respect to the vent *h*, leading to the beginning of the upper time train and the vent *o*, leading to the powder magazine *p*, both of which points are fixed by the angle subtended between the 0 and the 12-second settings. The flame now passes out through vent *g* and burns along the upper time train in an anticlockwise direction until the vent *j* is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the vent *o*, whence it is transmitted by the pellet of compressed powder *m* to the powder magazine *p*.

For the 21.2-second setting the vent *j*, leading to the beginning of the lower time train, is opposite the end of the upper time train, and the end of the lower time train is opposite the vent *o*, leading to the powder magazine. It will now be seen that to reach the magazine *p* and burst the shrapnel the entire length of time train in both rings must be burned.

As already stated, the annular grooves in the lower face of each ring for the powder trains do not form complete circles, a solid portion being left between the ends of the grooves in each. This solid portion is utilized to obtain a setting at which the fuze can not be exploded, known as the "safety point."

This point is marked by a line on the outer edge of the movable time train, surmounted by an "S," and is located about halfway between the zero mark and the 21.2-second graduation. When this point is brought opposite the line on the lower flange of the fuze body, the vent *j* is covered by the solid metal between the ends of the upper train, and the vent *o*, leading to the powder magazine *p*, is covered by the solid metal between the ends of the lower or movable time train.

At the safety setting it will be seen that the upper train may burn entirely out in case of accidental firing of the time plunger, or in case it may be desired to burst the shrapnel by impact or percussion, without the flame being able to reach the magazine *p*.

The cloth washers *c'* and *d'* are glued to the upper face of the graduated time-train ring and to the upper face of the flange on the



fuze stock. These surfaces are corrugated, as shown, to make the washers adhere more strongly. The function of the washers is to make a gas check and prevent premature action of the fuzes.

The compressed pellet  $j'$ , in the vent leading from the outside to the beginning of the lower time train, is to release the pressure of the gases due to the burning train. The gases from both time trains escape into the outer air through the annular spaces shown in the illustration and the vents  $b'$  in the closing cap.

The percussion element of this fuze as shown in the plate consists of a percussion plunger  $q$  and an ordinary percussion primer  $r$ .

The system of vents through the walls of the fuze shown in fig. 2 conduct the flame from the percussion primer to the magazine  $p$ .

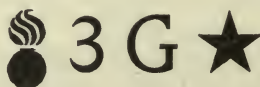
The bottom closing screw closes the percussion-plunger recess and keeps the powder in the magazine. The muslin washer  $v$  is coated with shellac and held in place by the brass washer  $w$ , over the outer edge of which a projecting lip is crimped.

These fuzes are issued assembled in shrapnel. For transportation in limbers and caissons the fuze should always be set at the safety point.

The fuze is provided with a waterproof hood of thin brass, hermetically sealed. The hood should be stripped off before an attempt is made to set the fuze.

#### MARKING ON AMMUNITION PACKING BOXES.

Both ends and sides of the box are marked with conspicuous characters to facilitate the rapid identification of the ammunition contained therein. The conspicuous marking consists of the following symbols:



The ordnance insignia (flaming shell) is always in red for mobile artillery ammunition. The numeral "3" refers to the caliber, and the letter "G" differentiates ammunition for the 3-inch field gun from ammunition for the 3-inch mountain howitzer. The numeral "3" and the letter "G" are in red for high-explosive shrapnel and in black for common steel shell.

The star when present in the conspicuous marking indicates that the projectiles are provided with tracers. A red star indicates a night tracer and a black star a day tracer.





Ejector Springs

Ejector Spring Screws

Base Set Screw

Sub-Cal. Cartridge Base, Case, and Head

Sub-Caliber Barrel, Cal. .30

Head Set Screw

Sub-Caliber Cartridge

Base Set Screw

Drill Cartridge Base, Case

Washer For Ring

Ring Screws

Washer For

Ring Graduated Ring

Rotating Pin

Stop Pin

Closing Cap

Closing Cap Set Screw

0 1 2 3 4 5 6 Inches

Drill Cartridge

In addition to the conspicuous marking the quantity and type of ammunition are indicated without symbols by the marking, "4 fixed common shrapnel," etc., so that in case one is not familiar with the conspicuous marking system he can immediately ascertain the key by this additional marking. Similarly, the word "Tracer" is added in amplification of the star symbol.

Also on both ends of the box the word "Lot," followed by a number, appears. This refers to the ammunition lot, and in case of any trouble arising with regard to the functioning of the ammunition this lot number should be quoted in the report.

On the sides of the box similar markings are found, accompanied by a pictorial stenciled symbol indicating the type of projectile, the tracers, and the fact that the ammunition is fixed.

For blank ammunition when packed assembled the numeral "3" and the letter "G" are in blue.

#### SUBCALIBER CARTRIDGE.

[Plate VII.]

The subcaliber cartridge is used for subcaliber practice. It consists of a .30-caliber rifle barrel 21.32 inches long, mounted axially in a bronze subcaliber cartridge case, and resembles in weight and exterior dimensions the ammunition regularly used with the gun. The breech end of the rifle barrel is screwed into the base of the subcaliber cartridge, while the muzzle end is threaded to take the ogival-shaped head, which accurately fits the bore at the front end of the subcaliber cartridge case and is capable of longitudinal motion to allow for expansion of the barrel. Two steel ejector springs are each assembled to the base by an ejector-spring screw.

During subcaliber practice the extractor of the gun will be removed in order to prevent the breechblock from defacing the base of the subcaliber cartridge. The subcaliber cartridge is inserted and pushed home in the gun. The subcaliber cartridge, caliber .30, is then inserted in the chamber of the subcaliber barrel until its rim comes in contact with the ejector springs. The breech of the gun is closed, the face of the breechblock coming in contact with the subcaliber cartridge, caliber .30, shoves it to its seat, compressing the ejector springs. When the breech is opened the ejector springs throw the case of the subcaliber cartridge, caliber .30, far enough to the rear to permit its removal by the fingers.

The ammunition for United States magazine rifles of any model must not be used in subcaliber cartridges, the primers not being adapted for the blow of the firing pins of cannon. A special caliber .30 cartridge has been adopted for this purpose, and requisition for subcaliber ammunition should call for "subcaliber cartridges, caliber .30."



As the residue of smokeless powder, if not completely removed, corrodes the bore in a short time, the subcaliber cartridges should be carefully cleaned after use. The bore should be cleaned with a rag saturated with soda water (one-half pound sal soda to 1 gallon boiling water) and wiped thoroughly dry with a clean rag. Then oil the bore with a light coating of light slushing oil or other suitable oil.

#### DRILL CARTRIDGE.

[Plate VII.]

The "drill cartridge" is a dummy cartridge for use in drilling cannoneers in the service of the gun. It is a bronze casting of the shape of the service shrapnel ammunition and is fitted at the point with a movable ring graduated the same as the ring upon the Frankford Arsenal 21-second combination fuze. This arrangement is for the instruction of cannoneers in fuse setting.

#### SUBCALIBER AND DRILL CARTRIDGE KIT.

The subcaliber and drill cartridge kit consists of—

3 drill cartridges, 1 extra base.	1 pin wrench.
1 subcaliber cartridge.	1 storage chest.
2 ejector springs.	6 rotating pins.
2 ejector-spring screws.	1 graduated ring with felt washer.
1 cleaning rod.	4 ring screws.
1 eyepiece.	2 closing cap set screws.
1 extension piece.	6 stop pins.
1 bristle-cleaning brush.	

One subcaliber and drill cartridge kit is issued for each gun.

#### ALLOWANCE OF AMMUNITION.

Shell and shrapnel ammunition is issued by the Ordnance Department in moisture-proof tin packing cans hermetically sealed and placed in wooden or metal packing boxes, 4 rounds per box. A load for a four-mule Army wagon varies from 23 to 28 boxes, and for a six-mule wagon from 32 to 37 boxes, depending upon the condition of the roads.

The annual allowance of ammunition for the instruction of Field Artillery is prescribed from time to time in War Department orders. These orders give full information as to the allowance of fixed and blank ammunition for the 3-inch guns, drill cartridges, subcaliber cartridges, revolvers, and shotguns and care of the same, disposition of empty shells, etc.

#### BLANK AMMUNITION.

Blank metallic ammunition is for use in salute firing, morning and evening gun firing, maneuver firing, etc., and consists of the following components: A brass cartridge case, a percussion primer, a charge of black powder, and a tight-fitting felt wad.

## THE CARTRIDGE CASE.

The cartridge case for blank ammunition for the 3-inch field gun is identical with the service cartridge case. Cartridge cases are issued unprimed, and primers should not be inserted until the ammunition is to be prepared for use.

Cartridge cases that have become deformed in service should be turned in to the posts or arsenals designated in current orders for resizing and re-forming.

## THE PRIMER.

The saluting primer (percussion) is used in the preparation of blank metallic ammunition for the 3-inch field gun. The primer should be a tight fit in the primer seat in the cartridge case, and must be pressed into place with the primer-inserting press provided for the purpose, and not hammered in. No primer should be used that is not a tight fit in its seat in the case.

Cartridge cases should be primed just before the insertion of the powder charge, and under no circumstances will primers be inserted after the powder charge has been inserted.

Primers are issued in hermetically sealed tin boxes, which should not be broken open until the primers are to be used, as they deteriorate when exposed to atmospheric influences.

## THE CHARGE.

The charge to be used in the preparation of blank metallic ammunition for the 3-inch field gun is  $1\frac{1}{2}$  pounds of saluting powder.

## PREPARATION OF BLANK METALLIC AMMUNITION.

Blank metallic ammunition will be assembled at posts or in the field under the personal supervision of a commissioned officer, who will be held responsible that it is prepared in the manner prescribed. (G. O. 9, War Dept., Jan. 11, 1908.)

For this purpose there are issued blank-cartridge cases, black powder in bulk, tight-fitting felt wads, rubberine, or other quick-drying paint, primers, etc.

Before assembling the cartridge cases should be carefully inspected to see that they are in sound condition and thoroughly clean and dry. They should also be tested by trying them in the gun, to determine whether they have become deformed. Any cases that do not readily enter the chamber in the gun or that are otherwise seriously deformed should be laid aside for resizing. After inspecting the cartridge cases the blank ammunition should be prepared as follows:

(a) Insert the primers with the primer-inserting press.

(b) Pour into the cartridge case the proper weight of black powder and shake it down well.

(c) Insert the felt wad and press it down hard until it rests squarely on the powder charge.

(d) Give the upper surface of the felt wad and the inside of the cartridge case just above the wad a good coat of the rubberine or other quick-drying paint furnished for the purpose, using a brush, and allow the case to stand until this coat is dry. Then apply another coat of rubberine paint in a similar manner. The object of using rubberine paint, which is strongly adhesive, is to thoroughly seal the joint between the wad and the case to prevent any powder grains from leaking out, and at the same time to firmly hold the wad in place.

#### PRECAUTIONS TO BE OBSERVED.

Firings with blank metallic ammunition will be greatly facilitated by a careful observance of the following:

Before all firings a careful examination should be made of the assembled rounds to see that the felt wads have not become displaced or the cartridge cases dented or deformed by careless handling. If the cartridge cases have been properly resized and are clean, no difficulty should be experienced in inserting them in the gun, provided the chamber of the latter is clean. The continued insertion of cartridge cases that are not clean causes an accumulation in the gun chamber which may make the insertion of subsequent rounds difficult or impossible.

In firing blank ammunition the gun chamber will be sponged after each round with a damp sponge, to extinguish sparks and remove powder residue resulting from the previous round, before the insertion of another round.

Care will be taken to see that the sponges are not worn and that they thoroughly fit the chamber. The interval between rounds in firing blank ammunition should be sufficient to allow thorough sponging of the chamber and examination to ascertain that all sparks have been extinguished.

Wads for the preparation of blank metallic ammunition are made to tightly fit in the cartridge case. No wads should be used that are not a tight fit in the case.

#### CARE OF CARTRIDGE CASES.

As soon after firing as practicable the exploded primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should then be thoroughly washed in a strong solution of soft soap and soda to remove all powder residue. It should then be thoroughly dried.

Before firing a salute with blank metallic ammunition all the cartridges to be used should be inserted in the gun to ascertain if they



will fit. In preparing ammunition for salutes, a few rounds in addition to the required number should be prepared for use in case of misfires. Lightly oiling the outside of cartridge cases just before use will facilitate their insertion and extraction.

If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required but the life of the cartridge case will be greatly prolonged.

A good solution for washing cartridge cases may be prepared by using ingredients in the following proportions: 1 gallon of water, 2½ ounces soft soap, 5½ ounces soda. The mixture should be boiled and stirred until the ingredients are entirely dissolved.

In washing cartridge cases this solution should be used hot and in sufficient quantity to completely immerse the cases.

Neither acids nor solutions of acids will be used for cleaning cartridge cases.

#### THE RELOADING AND CLEANING OUTFIT.

This outfit consists of the following parts, and is furnished to each battery and to each post where a saluting gun is kept:

Primer-inserting press, small.	Hammer.
Bushing.	Case holder.
Powder measure, saluting.	Case-holder stand.
Decapping tool, with guide.	Storage chest.
Cleaning brush.	

The bushing is used in the primer-inserting press for the insertion of new primers.

The decapping tool and case holder and stand are used for removing exploded primers from the cartridge cases. A light blow on the rod with a piece of wood or the bronze hammer generally removes the primer.

A powder measure to suit the saluting charge for the gun is furnished, and when level full holds the required charge.

The cleaning brush is furnished for cleaning the cartridge cases after they have been used and should be ordered to suit the size of case for which intended.

#### MISFIRES AND HANGFIRES.

"Misfires" and "hangfires" are of exceedingly rare occurrence with this ammunition. In case of the failure of the cartridge to fire when the trigger is pulled the breechblock *should not be opened* until after the expiration of at least one minute. The gun may be immediately recocked without opening the breech mechanism and the cartridge tried again (but the recocking should be done by means of a lanyard engaging the recocking ring of the cap of the firing pin); in doing

this, care should be taken that all parts of the body are out of the line of recoil of the gun. Defective cartridges and primers should be reported.

# FUZE SETTERS, MODEL OF 1905 M.

[Plate VIII.]

The fuze setter is a device for the rapid and accurate setting of fuze for various ranges and heights of burst.

Ammunition fitted with three types of fuzes are now in service, namely:

(a) *F. A. fuze, model of 1907*.—After exhaustion this type will not be replaced.

(b) *F. A. fuze, model of 1907 M*.—This fuze is the same as *F. A. fuze, model of 1907*, except that the fuze is provided with a fixed pin instead of a slot in the fuze body, and the fuze setter is provided with a fixed pin instead of a spring plunger.

(c) *Ehrhardt*.—The fuzes are assembled in *Ehrhardt* high-explosive shrapnel.

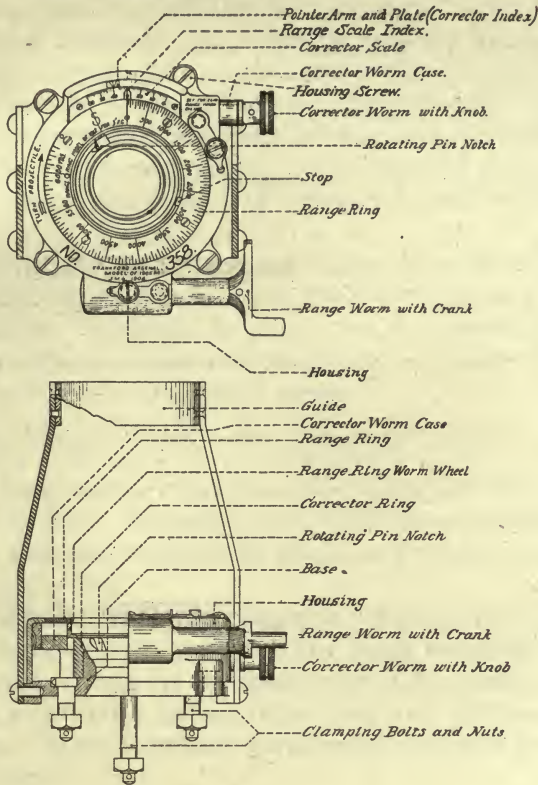
New range rings for *F. A. fuzes, models of 1907 and 1907 M*, are being issued. These range rings will replace all range rings marked "*F. A. fuze, model of 1907*" and "*F. A. fuze, model of 1907 M*." On the face side they are graduated to 6,400 yards and marked "*Range ring, model of 1912, for 3-inch F. G.*" This side should be used with *F. A. fuzes, models of 1907 and 1907 M*. The reverse side of these rings is graduated to 6,400 yards and marked "*Ehrhardt, 1911*," and will be used as indicated. The least division on each side is 50 yards, and they are figured at each 500 yards.

In assembling the range ring to the fuze setter the accuracy should be proved by setting a fuze with the fuze setter and verifying the result. Cards for recording the results of tests of fuze setters are furnished by the Ordnance Department on which the following problems are given. To check the fuze setter, set range ring and corrector scale to readings given, set the fuze with the fuze setter, and compare the setting of the fuze with the calculated setting below.

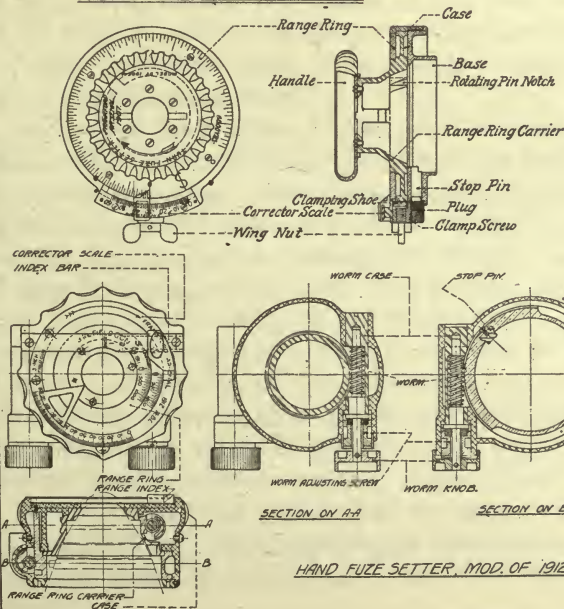
Use shrapnel and not a drill cartridge in making the test.

Range ring.	Corrector scale.	Calculated fuze setting.	
		Ehrhardt fuze, 1911.	21-sec. fuze.
0	30.0	0	0
2,000	3.9	5.71	5.99
3,750	45.0	8.92	9.22
5,500	30.0	16.76	16.95

# Bracket Fuze Setter



## Hand Fuze Setter.







The corrector scale is graduated into 60 equal divisions and is numbered each 10 divisions. It is used to vary the height of burst of shrapnel and to compensate errors made in determining the angle of sight and variations in the rate of burning of the time train of the fuze. In use the battery commander indicates the corrector reading desired. The division corresponding to 30 is the middle of the scale and indicates the normal height of burst of 3 mils under normal conditions.

Should it be desired to increase the height of burst an increased corrector scale reading is required, and for a lower burst a decreased reading is required. It should be noted that an increased corrector reading corresponds to a decreased range and a decreased corrector reading corresponds to an increased range.

#### THE BRACKET FUZE-SETTER, MODEL OF 1905 M.

The bracket fuze setter is attached to the rear end of the fuze-setter bracket on the caisson. It consists of the following principal parts: Base, housing, corrector-worm case, guide, and range and corrector worms, rings, and scales.

The base is attached to the fuze-setter bracket by four bolts. The housing, the corrector-worm case, and the guide are each secured to the base by screws. These are the fixed parts of the instrument. The housing forms a cover for the movable parts and affords a seat for the range worm. In the corrector-worm case are formed bearings for the corrector worm.

The corrector ring and the range-ring worm wheel (which carries the range ring) are the movable parts of the fuze setter. When assembled, the interior surfaces of these two rings, in connection with the bore of the fuze-setter base, form a socket, shaped to fit the exterior of the combination fuzes.

Upon a portion of the exterior of the corrector ring is formed a segment of a worm wheel meshing with the worm seated in a fixed part of the instrument (the corrector-worm case), so that turning the worm rotates the corrector ring. A notch is cut in the inner surface of the corrector ring to take the rotating pin, which projects from the graduated time-train ring of the fuze. The pointer arm attached to the corrector ring carries at its upper end flush with the upper surface of the fuze setter the pointer plate which is an index for the corrector scale. Suitable manipulation of the corrector worm moves the corrector ring until the index is set at any desired division of the scale.

The range-ring worm wheel is located within the housing and is mounted on the corrector-worm case and ring, and the worm wheel formed on its exterior surface meshes with the range worm, seated in bearings in the housing. The range ring is attached by four screws to the upper surface of the range-ring worm wheel and located by a

pin. This ring may therefore be set at any desired reading by suitable manipulation of the range worm.

Some of the earlier bracket fuze setters of model 1905 are provided with two corrector scales, one for "Ehrhardt" and the other for "F. A. and Krupp" fuzes, each plainly marked. The outer or Ehrhardt corrector scale is no longer used and is being removed when fuze setters are turned in for repairs. The inner or F. A. and Krupp scale is attached by screws to the housing and is used with ammunition having F. A. fuzes, models of 1907 and 1907 M and Ehrhardt fuzes, 1911.

The range ring is set for a given range when the division indicating that range is in line with the range-scale index, which is the central division on the corrector scale (not the corrector index). The corrector scale is set for a given correction when the corrector index (which is movable) is opposite the specified division of the corrector scale.

When 0 on the range ring is set opposite the range-scale index, which is engraved on the corrector scale, and the pointer-arm index is opposite 30 on the corrector scale, the fuze will be set at 0. When setting a fuze to explode on impact or for safe transportation the "S" on the range ring should be set opposite the range-scale index and the pointer-arm index set opposite 30 on the corrector scale. Great care should be exercised in making this setting.

To use the bracket fuze setter, set the range ring and corrector scale at the range and correction ordered by turning their respective worms; remove the weatherproof cover on the fuze by ripping off the soldering strip; place the point of the projectile in the fuze setter with the rotating pin of the graduated time-train ring engaging its notch in the corrector ring; hold the projectile against the guide, and while pressing the fuze firmly into the fuze-setter socket turn the projectile in a *clockwise* direction until the stop brings up against the side of the fixed stop pin in the body. Especial care must be taken to always rotate the projectile in a *clockwise* direction.

When not in use it should be secured in its traveling position and protected by the fuze-setter cover issued for this purpose. The earlier models of both bracket and hand fuze setters were fitted with a spring plunger to engage with a notch in the body of the fuze in order to limit the setting of the fuze. In the model of 1905 M the spring plunger has been replaced by a fixed stop.

The range worm, range-ring worm wheel, corrector worm, and corrector ring should be removed from time to time and thoroughly cleaned and oiled. To disassemble, remove the taper pin from the crank and the crank from the range worm; withdraw the worm. Unscrew the four housing screws and remove the housing and the range-ring worm wheel. Drive out the taper pin from the corrector-



worm knob; remove the knob from the corrector worm and withdraw the corrector worm. Unscrew the worm-case screws, and remove the corrector-worm case. Remove the corrector ring from base. Clean thoroughly, grease the worms and the gears, oil the bearings for worms, and assemble in reverse order.

#### THE HAND FUZE SETTER, MODEL OF 1905 M.

The hand fuze setter is provided for the same purpose as the bracket fuze setter, and is intended to supplement the latter. One hand fuze setter is issued in a leather case and is carried in the trail box of each gun. It is intended for use in case the bracket fuze setter should become disabled, or in case the gun should for any reason be separated from its caissons.

The names of the parts of the hand fuze setter and the manner in which they are assembled are shown in Plate VIII.

The corrector scale of the hand fuze setter is for the same purpose as that of the bracket fuze setter, but, unlike the latter, is incapable of adjustment independently of the range ring. In use, the range and correction having been ordered, the graduation line corresponding to the designated range is set opposite the graduation line corresponding to the designated correction.

A new design of corrector scale with sliding index has been adopted and will be issued to replace all of the old design. In use, the range and corrector setting having been ordered, the sliding index is set at the designated corrector setting and the graduation line corresponding to the range is set opposite the fiducial edge of the index. This will require that whenever the corrector or range is changed the fuze setter must be unclamped and a new setting made.

To use the hand fuze setter, loosen the clamp screw, set the range ring at the range and correction ordered, and clamp; remove the waterproof cover of the fuze; place the fuze setter over the point of the projectile and turn in a *clockwise* direction until the rotating pin of the graduating time-train ring engages in the notch provided for it; then press firmly down on the fuze setter and continue to turn in a *clockwise* direction until the stop pin in the fuze setter engages with the fixed stop pin in fuze body and prevents further rotation. Especial care must be taken to rotate the fuze setter in a *clockwise* direction.

The hand fuze setter should be disassembled from time to time and thoroughly cleaned and oiled. To disassemble: Remove the corrector-scale mechanism, unscrew the clamp screw, remove the clamp shoe. Remove plug, unscrew the base from the case, withdraw the range-ring carrier with range ring and handle from the case. Clean thoroughly, oil, and assemble in reverse order. To turn over the range ring it is necessary to remove the handle from the range-ring carrier

by removing the six handle screws and then remove the four range-ring screws.

The corrector scale with the sliding index must not be removed from the scale, as small parts may be lost and difficulty will be experienced in reassembling.

#### HAND FUZE SETTER, MODEL OF 1912.

The hand fuze setter is a device for rapid and accurate setting of the fuze for various ranges and heights of burst. Plate VIII shows assembled and sectional views and designation of parts. The principal parts are the case, the range-index mechanism, range mechanism, correction mechanism, and guide plate.

The case forms a housing for the movable parts and provides seats for the worm cases and the index bar. The slot, cut in the top of the case, limits the movement of the projecting segment of the corrector-scale support which carries the corrector scale. The serrated rim forms a handle for turning. The arrow engraved upon the top and lower center edge of the case coincides with the graduations of the corrector scale. Two oil-hole screws are located in the case directly under the serrated rim on both right and left sides and identified by the word "Oil."

The range-index mechanism consists principally of the index bar, range index, index plunger, and index spring. The index bar is retained in its seat, located in the case directly above the range-ring corrector-scale screws. On this scale is graduated 120 equal divisions, 50 minutes apart, numbered every 10 divisions. Graduation numbered 30 is the normal or zero position and is indicated by an arrow. The word "Turn" and an arrow engraved upon the corrector scale indicates the direction the fuze setter must be turned when setting a fuze. A pointer is riveted and soldered to the top of the corrector scale in a certain position to coincide with the graduated line on the closing cap of the fuze.

The range-ring carrier is seated in the corrector-scale support. The worm teeth mesh with the threads of the worm on the right side of the fuze setter. The slot, which is cut in the bottom side of the range-ring carrier, engages with the rotating pin in the graduated time-train ring of the fuze. The interior is conical in shape to suit the exterior of the fuze.

The corrector-scale support is held within the case by the guide plate. The worm teeth mesh with the threads of the worm on the left side of the fuze setter. The movement of the corrector-scale support is limited in both directions by the slot in the case. The stop pin is secured in the interior of the corrector-scale support by the stop-pin screw and engages with the fixed stop pin in the body of the fuze to limit the movement of the fuze setter.



The worms are mounted eccentrically in the worm cases which when turned provide an adjustment to take up the wear between the worm teeth of the range-ring carrier or corrector-scale support and the threads of their respective worm. The worm cases have screw-driver slots at their rear ends, which are provided for adjusting and are locked in position by the worm-case clamp plugs, which are secured by the worm-case clamp screws. The worm-adjusting screws have fiber washers fitted in their ends that bear upon the collars of the worms for taking up end motion and to provide sufficient friction to resist accidental turning. A screw-driver slot is located at their front end for adjusting. The worm-adjusting screws are locked in position by the worm-adjusting screw clamp plugs which are secured by the worm-adjusting screw clamp screws. The worm knobs are secured to the worms by taper pins. The exterior of the worm knobs is straight knurled to facilitate turning. The guide plate is screwed in its threaded seat in the bottom of the case and retained in position by the guide-plate lock screw.

#### DISASSEMBLING AND ASSEMBLING.

To disassemble remove the index-bar mechanism, which is held in place by two index-bar screws. Take out the three range-ring screws and the two corrector-scale screws and remove the range ring and the corrector scale. Remove the guide-plate lock screw and unscrew the guide plate, using a teat wrench. To remove the worm knobs from the worms drive out the taper pins. Loosen the worm-adjusting screw clamp screws which release the worm-adjusting screw clamp by two index-bar screws and forms a slide for the range index. The V-shaped notches in the index bar are marked with numbers 1, 2, and 3 with the word "zone," which agree with the zones of the range ring. The range index sliding upon the index bar is held in position by the index spring forcing the index plunger into the V-shaped notches of the index bar.

The range mechanism consists principally of the range ring, range-ring carrier, worm, worm case, worm-adjusting screw, and worm knob.

The correction mechanism consists principally of the corrector scale, corrector-scale support, worm, worm case, worm-adjusting screw, and worm knob.

The range ring is located upon the range-ring carrier by a steel dowel pin and secured in position by three range-ring screws. The outer zone or zone 3 is graduated for the "21-second fuze" and the middle zone or zone 2 is graduated for the "Ehrhardt fuze, 1911." Both scales are graduated for ranges of 6,400 yards; least division is 50 yards and numbered every 500 yards. The data for graduating



the range ring is computed from actual corrected firings and then corrected for a suitable height of burst of 3 mils. The graduated surface is sand blasted and lacquered.

The corrector scale is mounted upon the projected segment of the corrector-scale support and secured by two plugs. Remove the worm-adjusting screws. The worms can now be removed by turning. The corrector-scale support and range-ring carrier can then be removed. To remove the worm cases, loosen the worm-case clamp screws, which release the worm-case clamp plugs.

Assemble in reverse order.

#### ADJUSTMENT.

Backlash or lost motion may appear between the collars of the worms and the fiber washers endwise; between the worm teeth of the range-ring carriers or the corrector-scale support and the threads of their respective worms.

To remove the end backlash, loosen the worm-adjusting screw clamp screw, which releases the worm-adjusting screw clamp plug; then turn the worm-adjusting screws clockwise, using a screw driver, until the end play is removed and there is sufficient friction to prevent accidental turning of the worms. The worm-adjusting screw clamp plugs must be firmly clamped after adjusting, by tightening the worm-adjusting clamp screws, which secures the worm-adjusting screws against rotation.

Should backlash appear between the worm teeth of the range-ring carrier or the corrector-scale support and the threads of their respective worms, it can readily be removed by loosening the worm-case clamp screws, which release the worm-case clamp plugs, and then turning the worm cases, using a screw driver in a slot at the rear end, in which the worms are eccentrically mounted, so as to bring the worms in closer contact with the worm teeth. The worm-case clamp plugs must be firmly clamped after adjusting by tightening the worm-case clamp screws which secure the worm cases against rotation.

#### OPERATION.

First. Set the range index on the index bar to correspond with the fuze to be used.

Second. Turn the worm knob, pinned to the worm and located at the front-right side of the fuze setter, until the desired range on the range ring registers with the range index.

Third. Turn the worm knob, pinned to the worm and located at the front-left side of the fuze setter, until the graduated line on the corrector scale, which indicates the desired correction for height of burst, registers with the engraved arrow on the case.

The graduation, numbered 30 and indicated by an arrowhead, is the normal height of burst under normal conditions. A decreased reading on the corrector scale decreases the height of burst and increases the range, and increased reading increases the height of burst and shortens the range.

To set a fuze, remove the waterproof cover, place the fuze setter over the fuze and turn until the slot in the bottom of the range-ring carrier engages with the rotating pin in the graduated time train ring of the fuze. The guide plate and conical interior of the range-ring carrier will then rest upon the fuze. Turn the fuze setter clockwise, as indicated by the arrow on the corrector scale until the stop pin fastened to the corrector-scale support engages with the fixed stop pin in the body of the fuze and further motion is prevented.

The pointer, which is attached to the top of the corrector scale, should register with the gradual line on the closing cap, to indicate that the stop pin of the fuze setter and the fixed-stop pin of the fuze are in contact. This pointer is added, as the graduated time train ring of the fuze has tendency to stick or to bind to such a degree as to indicate that the stop pin of the fuze setter and the fixed-stop pin of the fuze are in contact.

Cards for recording the results of tests of the fuze setters are furnished by the Ordnance Department for each size of gun, howitzer, or mortar, on which computed problems of inspection are given as indicated below. The examples given below are for 3-inch field gun. The cards for other calibers are similar.

Range ring.	Corrector scale.	Computed settings.		Fuze settings.	
		21-sec. fuze.	Ehrhardt fuze, 1911.	21-sec. fuze.	Ehrhardt fuze, 1911.
0	30	0	0		
.2,000	4	5.99	5.71	.....	.....
3,750	45	9.22	8.92	.....	.....
5,500	30	16.95	16.76	.....	.....

To check the fuze setter, set the range ring and corrector scale to that tabular readings. Set the fuze with the fuze setter and compare the results with the computed setting in the table. Use shrapnel and not a drill cartridge in making this test. When the range index registers with 0 on the range ring and the corrector scale at 30, the fuze is set at 0, and will explode immediately on leaving the gun. When setting a fuze to explode on impact, set the range index at S and the corrector scale at 30.

#### CARE AND PRESERVATION.

The interior of the fuze setter can be oiled by removing the oil-hole screws; the locations are identified by the word "oil."



## THE 3-INCH GUN CARRIAGE, MODEL OF 1902.

## WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of carriage, complete, with 4 rounds of ammunition, weighing 75 pounds	pounds	1, 685
Weight of gun and carriage, complete	do	2, 520
Weight at end of trail, carriage limbered	do	115
Diameter of wheels	inches	56
Width of track	do	60
Length of recoil of gun on carriage	do	45
Height of axis of gun	do	40. 875
Height of line of peep sight	do	44. 9
Length of peep-sight radius	do	36. 75
Maximum angle of elevation	degrees	15
Maximum angle of depression	do	5
Amount of traverse of gun on carriage	mils	140
Rounds of ammunition carried on carriage		4

## NOMENCLATURE OF PARTS OF CARRIAGE.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Axle			
1	Trail, consisting of—			
2	Flasks (right and left)	Form right and left side of trail		
2	Axle bearings (right and left)	Riveted to front end of flasks, right and left.		
2	Bushings (axle bearing)	One in each axle bearing		
4	Bolts for axle bearing	Clamp bearing to axle		
1	Elevating-gear transom	Riveted between flasks		
	Consisting of—			
1	Transom, front	Forms front of elevating-gear transom		
1	Transom, rear	Forms rear of elevating-gear transom		
2	Transoms, middle	Between front and rear transoms		
2	Transom bearings	One riveted to each middle transom		
8	Bolts for elevating-gear transom	Hold middle transom in place		
1	Tool box	Riveted between flasks		
	Consisting of—			
1	Tool-box transom, front	do		
1	Tool-box transom, rear	do		
1	Tool-box bottom	Tool box in trail		
1	Tool-box top plate	Riveted to top of flasks and tool-box transom, front.		
1	Tool-box cover, with 2 hinges and 2 pins	Forms top of tool box		
1	Tool-box fastening	Fastened to lid and rear transom		
	Consisting of—			
1	Handle	At rear end of tool-box lid	IV	3
2	Eyes	Riveted to tool-box transom, rear		
2	Clips	Riveted to tool-box lid		
2	Guides	do		
1	Stop	do		
1	Rear-sight box cover	Forms top of rear-sight box		
1	Rear-sight box projection	Riveted to rear-sight box bottom		
1	Catch	Riveted to rear-sight box cover		
2	Rear-sight box cover hinges and 2 pins	Riveted to cover		
1	Rear-sight box bottom	Forms bottom of rear-sight box		
1	Lock-chain rivet, with chain	Riveted to left flask		
1	Lock eye	Riveted to rear-sight box cover		
1	Rear-sight packing, No. 1	Fastened to rear-sight box bottom		
2	Rear-sight packing A	Riveted to rear-sight box cover		
1	Rear-sight packing B	do		
1	Wheel-guard transom	Riveted between flasks at rear end of rear-sight box.		
1	Rear-sight box and trail top plate	Riveted to top of flasks		
1	Spade	Riveted to ends of flasks		
1	Spade edge	Riveted to face of spade		
1	Spade brace	Riveted to spade		
1	Spade point	Riveted to spade brace		
1	Crosstie	Riveted between trail flasks at spade end.		



## NOMENCLATURE OF PARTS OF CARRIAGE—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Trail, consisting of—Continued.			
1	Spade, reinforce, side, right	Riveted to spade.		
1	Spade, reinforce, side, left	do.		
1	Float	Riveted to spade and flasks.		
1	Lunette bracket	Riveted on float.		
1	Filler (for lunette bracket)	Pinned to float.		
1	Handspike fulcrum	Riveted on lunette bracket, spade, and float.		
1	Lunette bracket reinforce	Riveted between lunette bracket and trail.		
1	Handspike fastening	Riveted to trail cover plate.		
2	Wheel guards, 1 right, 1 left	Riveted to flasks and wheel-guard transom.		
1	Trail handle (right)	Riveted on float and spade.		
1	Trail handle (left)	do.		
2	Trail seats	Riveted to seat supports.		
1	Trail-seat support (right)	Riveted to flask.		
1	Trail-seat support (left)	do.		
1	Elevating and traversing lock, consisting of—			
1	Bolt	Fastens hinge to elevating gear transom.		
1	Hinge	Riveted to elevating-gear transom, rear.		
1	Hook	Pinned to hinge.		
1	Hook center	Pinned to hook.		
1	Pin	Connects hinge, hook, and hook center.		
1	Spring	Bolted to hinge.		
1	Link	Joins spring and hook.		
2	Link pins	Pinned in link.		
1	Lug	Riveted to cradle.		
1	Sponge-staff socket	Riveted to right flask.		
1	Sponge fastening	do.		
	Consisting of—			
1	Hasp	On sponge fastening.		
1	Bolt	do.		
1	Twisted coil chain	Attached to bolt.		
1	Pin	On sponge fastening.		
1	Name plate	Riveted to tool-box hinge plate.		
1	Handspike	On handspike fulcrum.		
1	Handspike bolt	Secures handspike to fulcrum.		
1	Lunette, with nut	In lunette bracket.		
1	Padlock	Fastened to chain on left flask.		
1	Bolt snap	do.		
1	Cradle, consisting of—			
1	Cradle body	Below gun.		
1	Cradle head, rear (carriages Nos. 1 to 168).	Riveted on body.		
1	Cradle head, rear (for carriages 169 and up).	do.		
1	Cradle top plate	Riveted on top of body.		
1	Gun slide (right)	Riveted on body and cover plate.		
1	Gun slide (left)	do.		
1	Felt washer	In cradle head, rear.		
1	Pintle, with 2 spring covers	Riveted on bottom of body.		
2	Oil tubes	In pintle.		
1	Traversing lug	Riveted on bottom of body.		
1	Rear clip, with 2 spring covers	do.		
1	Bracket seat, firing handle	Riveted on right side (carriages Nos. 1 to 168).		
1	Recoil-indicator guide	Riveted on right side.		
1	Quadrant fastening	do.		
2	Shoulder-guard fastenings, 1 front, 1 rear.	Riveted on left side.		
1	Shoulder-guard clip (front)	do.		
1	Clip filler piece	Behind front clip.		
1	Shoulder-guard clip (rear)	Riveted on left side.		
1	Shoulder-guard brace	Secures shoulder guard to cradle.		
1	Rear-sight bracket support	Riveted on left side.		
1	Front-sight bracket support	do.		
2	Retaining-ring bolt fastenings	Riveted near front end.		
1	Spring-support guide (right)	Riveted inside cradle.		
1	Spring-support guide (left)	do.		
1	Retaining ring, with hasp	In front end of cradle.		
2	Retaining-ring bolts, with nuts	In bolt fastening.		
2	Retaining-ring bolt pins	do.		
1	Cradle head, front.	In retaining ring.		
	Consisting of—			
1	Bushing	In front cradle head.		
1	Handle for cradle head	On cradle head, front.		
1	Hasp eye	do.		

IV

3

## NOMENCLATURE OF PARTS OF CARRIAGE—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Shoulder guard.....	On rear end of cradle.....	IV	3
1	Shoulder-guard pin.....	Secures shoulder guard to cradle.....		
1	Dust guard, with 4 spring covers and 2 recoil-indicator throw hinges.....	4J for model of 1902; 89J for model of 1905, and 90G for model of 1904 guns. On cradle guide rails.....		
1	Cradle brush.....	Riveted to dust guard.....		
	Consisting of—			
1	Brush plate.....	Part of cradle brush.....		
1	Rear felt plate.....	do.....		
1	Front felt plate.....	do.....		
1	Recoil indicator.....	In indicator guide.....		
	Consisting of—			
1	Guide.....	Riveted to cradle.....		
1	Spring.....			
1	Slide.....			
2	Washers.....			
1	Pointer.....			
1	Recoil-indicator throw.....	Attached to dust guard by recoil-indicator throw hinge.....		
2	Recoil-indicator throw hinges.....	Attached to dust guard.....		
1	Firing shaft.....	In firing-shaft bearing (carriages Nos. 1 to 168).....		
1	Firing-shaft bearing.....	Riveted to right side of cradle.....		
1	Firing handle, with spring and plunger.....	On firing shaft (carriages Nos. 1 to 168).....		
1	Firing mechanism.....	For carriages after No. 168.....		
	Consisting of—			
1	Firing-handle bracket seat.....	Riveted on right side of cradle.....		
1	Firing-handle bracket.....	Assembled on bracket seat.....		
1	Adjusting screw.....	Assembled in bracket.....		
1	Adjusting-screw check nut.....	Assembled on screw.....		
1	Shaft trip collar.....	Assembled on firing shaft.....		
1	Firing-handle hub.....	Assembled on shaft in bracket.....		
1	Firing handle.....	Assembled on hub.....		
	with—			
1	Stop.....	Fastened to rear cradle head.....		
1	Plug.....	Assembled with handle.....		
1	Plunger.....	do.....		
1	Spring.....	do.....		
1	Pin.....	do.....		
2	Bracket studs and nuts.....	Riveted on cradle.....		
1	Shaft return spring.....	Rear end of bracket.....		
1	Handle return spring.....	Front end of bracket.....		
1	Trip collar pin.....	Secures trip collar to shaft.....		
1	Trip latch.....	Attached to trip latch plunger.....		
1	Trip latch pin.....	Secures trip latch to plunger.....		
1	Trip latch spring.....	Assembled in firing-handle hub.....		
1	Firing shaft.....	Assembled in bracket.....		
1	Trip latch plunger.....	Assembled in firing-handle hub.....		
1	Cylinder with cylinder end screwed in.....	In cradle.....		
1	Cylinder end washer.....	Fits in cylinder end.....		
1	Cylinder end stud.....	Connects cylinder to gun.....		
1	Cylinder end stud nut.....	On cylinder end stud.....		
1	Screw for cylinder end.....	Prevents cylinder end unscrewing.....		
1	Counter-recoil buffer.....	Screwed and pinned on cylinder end stud.....		
1	Cylinder head with 3 screw eyes.....	Front end of cylinder.....		
1	Cylinder head washer.....	In cylinder head.....		
1	Gland.....	Screwed on head.....		
1	Lashing wire.....	Lashes, gland, cylinder head and plug together.....		
5	Rings, packing.....	Garlock hydraulic waterproof packing, 0.25 inch square.....		
1	Piston rod, with plug, screwed in.....	In cylinder.....		
1	Piston.....	At rear end of piston rod.....		
1	Piston-rod nut.....	At front end of piston rod.....		
1	Filling plug with gasket.....	Screwed in end of piston rod.....		
1	Drain plug.....	Screwed into cylinder head.....		
1	Drain plug gasket.....	Fits in cylinder head.....		
1	Spring support.....	In cradle on cylinder.....		
3	Counter-recoil springs.....	do.....		
23	Outer counter recoil springs.....	do.....		
23	Inner counter recoil springs.....	do.....		
22	Separators.....	Used between inner and outer recoil springs.....		

<sup>1</sup> On repaired carriages this is part of the cradle head, rear.

<sup>2</sup> Issued in place of the flat counter recoil springs.

## NOMENCLATURE OF PARTS OF CARRIAGE—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Rocker, complete.....	On axle between flasks.....	IV	3
	Consisting of—			
1	Angle.....			
1	Pintle socket with bushings and spring covers.....	Riveted to rocker angle.....		
1	Traversing-gear case.....	do.....		
1	Traversing plate.....	do.....		
1	Traversing-plate liner.....	do.....		
1	Azimuth scale with filler piece.....	do.....		
1	Traversing mechanism, complete.....	In gear case on rocker.....		
	Consisting of—			
1	Handwheel with handle and spindle..	On end of shaft.....		
1	Traversing shaft.....	In bearings in gear case.....		
1	Nut.....	Mounted on shaft.....		
1	Bushing.....	In right end of case.....		
1	Traversing-shaft bearing, outer.....	Riveted on left side of trail.....		
1	Cap.....	Attached to traversing shaft bearing, outer.....		
1	Bearing locking pin with spring.....	Fits in traversing shaft bearing, outer.....		
1	Traversing-shaft adjusting nut.....	Mounted on shaft.....		
1	Traversing-shaft bearing.....	In left end of case.....		
1	Taper pins.....	Hold traversing shaft bearing in place.....		
1	Traversing link with bushing, spring cover, and plate for closing groove.....	Between case and cradle.....		
1	Traversing-link pivot with nut.....	In traversing lug on cradle.....		
1	Azimuth pointer.....	Attached to rear clip by screws.....		
2	Azimuth-pointer screws.....			
1	Elevating mechanism, consisting of—			
1	Elevating pin.....	Secures inner screw to rocker.....		
1	Inner elevating screw.....	Between rocker and outer elevating screw.....		
1	Outer elevating screw.....	Between inner elevating screw and elevating gear bracket.....		
1	Elevating gear bracket, with 4 bushings and 2 handy oilers.....	On bearing in trail transoms.....		
1	Elevating bevel gear.....	In elevating gear bracket.....		
2	Keys.....	Riveted in bevel gear.....		
2	Elevating bevel pinions.....	Mounted on shafts.....		
2	Elevating bevel pinion taper pins.....	Secures pinions to shaft.....		
2	Elevating crank shafts, with handles and washer.....	In elevating gear bracket.....		
1	Elevating screw cover.....	Lower end of bracket.....		
	Consisting of—			
1	Large disk.....			
1	Intermediate disk.....			
1	Small disk.....			
1	Body.....			
2	Axle seats, complete, include—			
2	Bracket fastenings (right).....	Clamped on each end of axle.....		
2	Bracket fastenings (left).....	do.....		
5	Bracket fastening and segment bracket bolts.....	Clamp brackets on axle.....		
1	Seat (right).....			
1	Seat (left).....			
2	Seat supports.....	Form braces under seat.....		
4	Special bolts and nuts.....	For seat supports.....		
4	Special bolt pin.....	Attach supports to special bolts.....		
1	Seat arm (right).....	Riveted to seat-arm bracket.....		
1	Seat arm (left).....	do.....		
1	Seat-arm bracket (right).....	Riveted to right seat.....		
1	Seat-arm bracket (left).....	Riveted to left seat.....		
1	Seat-arm guard (right).....	Riveted to right seat arm and shield brace.....		
1	Seat-arm guard (left).....	Riveted to left seat arm and shield brace.....		
1	Seat-arm support, (right).....	Supports seat arm on rear.....		
1	Seat-arm support, (left).....	do.....		
2	Shield-brace bolts, with nuts.....	Through shield brace, seat arm, seat-arm support, and shield-brace clip.....		
2	Ammunition carriers (right and left).....	Bolted to bracket fastening.....		
	Consisting of—			
2	Brake bracket tube (right).....	Attached to axle by tube support plates and bracket fastenings.		
2	Brake bracket tube (left).....			
2	Faceplates.....			
2	Tube-support plates.....			
2	Plate angle.....			
2	Tube heads (right).....	Riveted to rear end of tube.....		
2	Tube heads (left).....	do.....		



## NOMENCLATURE OF PARTS OF CARRIAGE—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Ammunition carriers (right and left)—Con.			
	Consisting of—Continued.			
4	Tie-rod fastenings, with nuts	Riveted to side of tube		
8	Filler rings (upper and lower)	Inside tubes		
4	Reinforce rings	do		
2	Filler pieces	Between tube heads		
2	Apron-latch brackets	One riveted to each pair of tubes		
4	Apron-latch bracket reinforce	Inside of tubes		
2	Brake-beam tubes	Connects front end of each pair of tubes		
2	Brake-beam guide	In brake-beam tubes		
2	Brake-beam fulcrum	do		
2	Foot rests	Front end of tubes		
2	Foot-rest braces	do		
4	Tie rods	Brace tubes from bracket fastening		
2	Tie-rod washers	On tie-rod fastenings		
4	Tie-rod pins	Through bracket fastenings		
2	Shield braces	Brace tubes from shield		
2	Covers, tube, with hinge pins	Hinged to tubes		
2	Cover latches, tube, with pins	Secure covers		
4	Cover-latch springs, tube			
1	Road brake, complete, includes—			
2	Brake beams	Seated in brake beams tubes		
2	Brake shoes	End of brake beams		
4	Brake-shoe tap bolts	Secure shoes to beams		
2	Fulcrum pins	Pivots for beams		
2	Brake-rod ends	On end of beams		
2	Brake rods	Between brake-rod end and spring		
2	Springs	Inside of spring cover		
2	Spring covers	Between spring-cover head and spring-cover end		
2	Spring-cover heads	Slide on brake rod		
2	Spring-cover ends	Connect spring covers with brake crank and lever		
4	Brake-rod pins	Through beams and cranks		
1	Crank	On end of brake shaft		
1	Brake lever	do		
2	Brake-lever catch	On lever		
1	Lever hook	On brake lever		
1	Brake shaft	In bearing, near axle		
2	Bushings	In brake-shaft bearings		
1	Segment bracket	Clamped on axle		
1	Segment-bracket bolt, with nut			
1	Brake segment with two segment racks	Riveted to segment bracket		
2	Apron latches, complete, include—			
2	Apron-latch blocks	Bolted to apron-latch bracket, which is riveted to the ammunition tubes		
2	Apron-latch bolts and nuts	Secure block to bracket		
2	Apron-latch pins	Form pivot for apron-latch body		
2	Apron-latch bodies	Pivoted on block		
2	Apron-latch levers	Pivoted on bodies		
2	Apron-latch lever pins			
2	Apron-latch plungers	Seated in body		
2	Plunger eyes	Screwed on end of plunger		
2	Plunger-eye pins	Attach plunger eye to lever		
2	Apron-latch springs	In body around plunger		
2	Apron-latch bushings	Screwed into body		
1	Apron shield, consisting of—			
1	Apron	Hinged to bracket fastening		
4	Apron hinges	Riveted to apron		
4	Apron-hinge pins	Through apron hinges and bracket fastenings		
4	Apron-hinge fillers, used with 0.15 armor plate	Riveted to apron		
2	Apron-latch staples	do		
1	Main shield, complete, consisting of—			
1	Main shield	Bolted to bracket fastenings and axle bearings		
1	Hood	Riveted to main shield		
1	Hood angle	Riveted to hood		
1	Shutter, peep-sight port	Hinged to shield		
1	Shutter, panoramic-sight port	do		
1	Shutter support	Riveted to shutter		
1	Shutter-latch base	do		
1	Shutter-latch plunger	In shutter-latch base		
1	Shutter-latch spring	do		
6	Hinge, sight port shutter	On shield		
1	Hinge pin, sight port shutter	In hinges		
2	Filler, shutter hinge	Between hinge and shield		

IV

3

## NOMENCLATURE OF PARTS OF CARRIAGE—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Main shield, complete, consisting of—			
	Continued.			
2	Wing nuts (front).....	Riveted on shield.....		
2	Wing nuts (rear).....	do.....		
2	Wing-nut pins (front).....	Riveted to shield.....		
2	Wing-nut pins (rear).....	do.....		
4	Wing-nut pin washers.....	On pins.....		
4	Bracket-fastening fillers.....	Bolted in bracket fastening with shield.		
1	Shield-brace clip (right).....	Riveted to shield.....		
1	Shield-brace clip (left).....	do.....		
1	Top shield center hinge (lower half).....	do.....		
1	Top shield outer hinge (lower half), right.....	do.....		
1	Top shield outer hinge (lower half), left.....	do.....		
12	Washers for shield bolts.....			
4	Bolts, 1.265 grip, with nuts.....	Through shield, ammunition carriers, bracket fastenings, and washers.		
4	Bolts, 0.92 grip, with nuts.....	Through shield, bracket, seat, ammunition carriers, and washers.		
2	Bolts, 1.05 grip, with nuts.....	Through shield, bracket, seat, ammunition carriers, seat-arm support, and washers.		
2	Bolts, 0.64 grip.....	Through axle bearings, shield, and washers.		
1	Top shield, complete, consisting of—			
1	Top shield.....	Hinged to main shield.....		
1	Top shield center hinge (upper half).....	Riveted to top shield.....		
1	Top shield outer hinge (upper half), right.....	do.....		
1	Top shield outer hinge (upper half), left.....	do.....		
1	Top shield center hinge pin.....	Connects parts of hinges.....		
2	Top shield outer hinge pins.....	do.....		
2	Top shield fastenings.....	Pivoted to fastening hinge.....		
4	Fastening hinges.....	Riveted to top shield.....		
2	Fastening-hinge pins.....			
1	Range quadrant case bracket, consisting of—			
1	Bracket.....	Bolted on rear face of main shield, right side.		
1	Right spring support.....	Riveted to bracket.....		
1	Left spring support.....	do.....		
1	Range quadrant case, complete, consisting of—			
1	Lid.....	Swung between springs by box supports, in bracket.		
1	Body.....	do.....		
1	Bottom.....	do.....		
1	Box support, left.....	Riveted on case.....		
1	Box support, right.....	do.....		
2	Bearing plate, left (upper and lower).....	Riveted to left box support.....		
1	Bearing plate, upper, right.....	Riveted to right box support.....		
1	Bearing plate, lower, right.....	do.....		
2	Case hinges (upper half).....	Riveted on lid.....		
2	Case hinges (lower half).....	Riveted to back of case.....		
3	Hinge pins.....			
1	Hasp hinge.....	Riveted on case lid.....		
1	Hasp.....	Riveted on case front.....		
1	Wing nut.....	Riveted on case.....		
1	Wing-nut pin and washer.....	do.....		
1	Wing-nut pin reinforce.....	do.....		
1	Chain eye.....	do.....		
1	Padlocks chain.....	Attached to chain eye.....		
7	Leather-covered packing blocks.....	Screwed to inside of case.....		
2	1/4-inch button head bolts with nuts.....	Bolt bracket to seat.....		
2	Washers.....	Go with bolts.....		
3	Bolts with nuts.....	Secure case to bracket.....		
3	0.375 pipes.....	On bolts.....		
6	Springs, quadrant case.....	Not interchangeable with sight-case springs.		
1	Padlock.....	Fastened to quadrant case.....		
1	Bolt snap.....	do.....		
1	Panoramic sight case bracket, complete, consisting of—			
1	Bracket, sight case.....	Bolted on rear face of main shield, left side.		
1	Spring support (right).....	Riveted to bracket.....		
1	Spring support (left).....	do.....		

IV

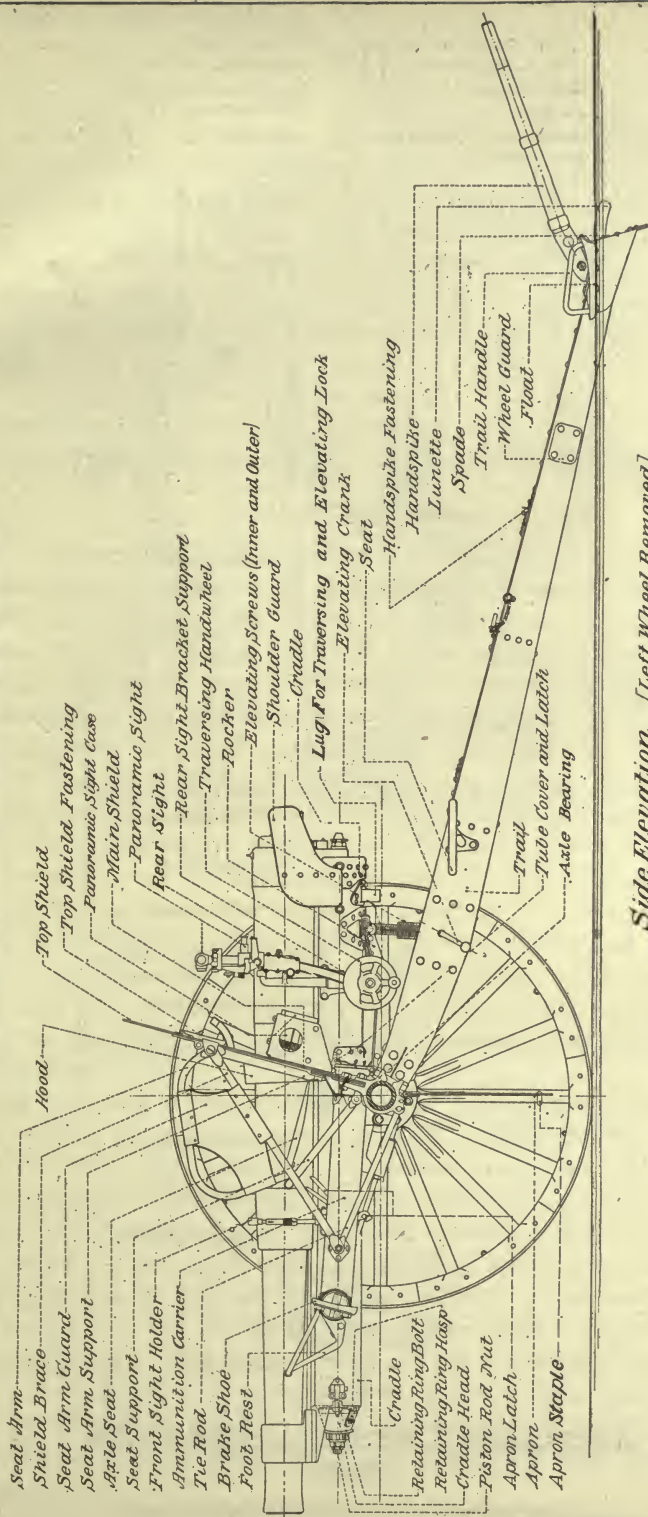
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## NOMENCLATURE OF PARTS OF CARRIAGE—Continued.

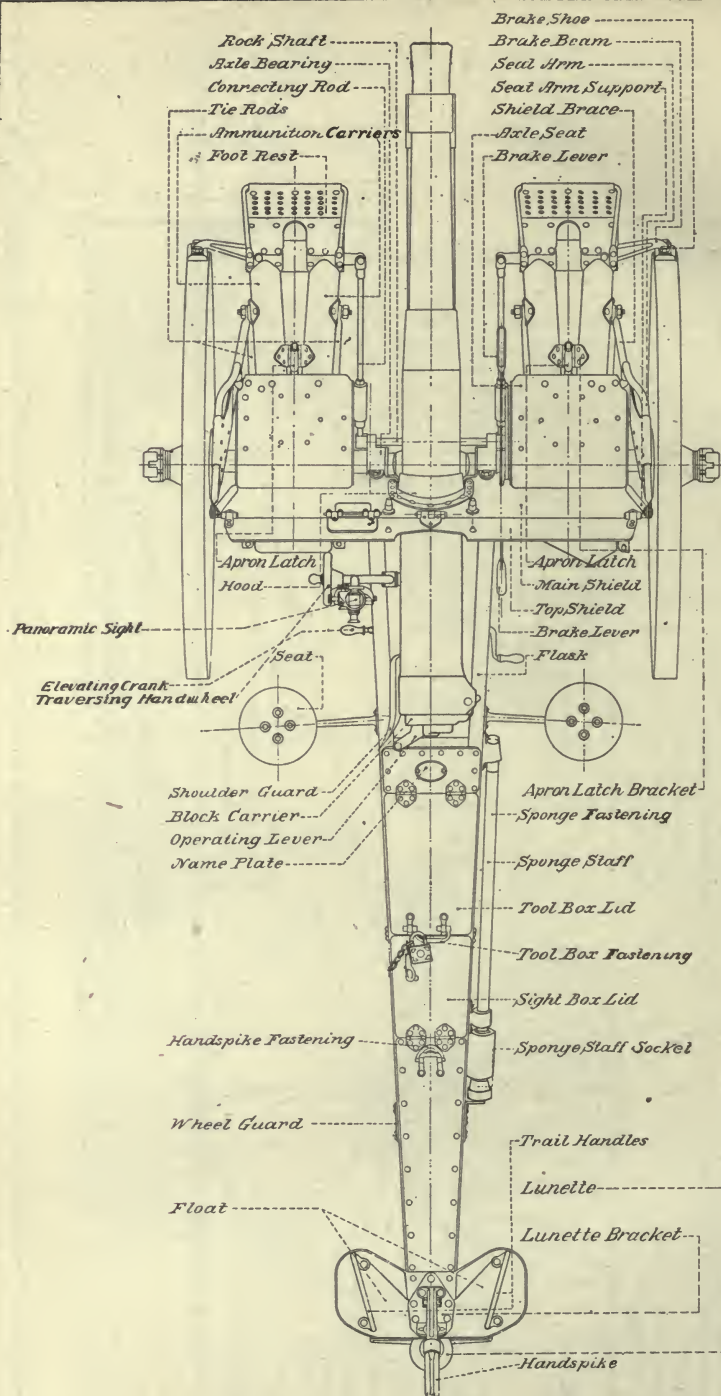
No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Panoramic sight case, complete, consisting of—		IV	3
1	Lid.....	Suspended between springs in bracket.		
1	Body.....	.....do.....		
1	Bottom.....	.....do.....		
2	Box supports.....	Riveted to case.....		
2	Bearing plates, upper.....	Riveted to spring supports.....		
2	Bearing plates, lower.....	.....do.....		
2	Case hinges, upper half.....	Riveted on case lid.....		
2	Case hinges lower half.....	Riveted to back of case.....		
3	Hinge pins.....	.....do.....		
1	Hasp hinge.....	Riveted on case lid.....		
1	Hasp.....	Riveted on case front.....		
1	Wing nut.....	Riveted on case.....		
1	Wing-nut pin and washer.....	.....do.....		
1	Wing-nut pin reinforce.....	.....do.....		
1	Chain eye.....	.....do.....		
1	Padlock chain.....	Attached to chain eye.....		
5	Leather-covered wood packing blocks.....	Screwed to inside of case.....		
2	1-inch button head bolts, with nuts.....	Bolts bracket to shield.....		
2	Washers.....	Go with nuts.....		
4	Bolts with nuts.....	Secure case to bracket.....		
4	0.375 pipes.....	On bolts.....		
8	Springs, sight case.....	Not interchangeable with quadrant-case springs.....		
1	Padlock.....	Fastened to panoramic sight case.....		
1	Bolt snap.....	.....do.....		
1	Front sight, complete, consisting of—			
1	Front-sight bracket.....	Rests in socket riveted to cradle.....		
1	Sleeve.....	Threaded to bracket.....		
1	Holder.....	Supports ring with cross wires.....		
1	Rear sight, complete, consisting of—			
1	Rear-sight bracket with shank socket.....	Fastened by two nuts to bracket support riveted to cradle.....		
1	Rear-sight shank.....	Constitutes the "rear" sight.....		
1	Shank-socket cover.....	Bolted to shank socket.....		
1	Panoramic sight.....	Fitted to rear sight shank.....		
1	Range quadrant.....	.....do.....		
2	Wheels, 56-inch, complete, consisting of—			
16	Tire bolts, with nuts and washers.....	.....do.....		
8	Dowels.....	.....do.....		
64	Felloe rivets and washers.....	.....do.....		
8	Felloe segments.....	.....do.....		
16	Spokes, right.....	.....do.....		
16	Spokes, left.....	.....do.....		
2	Tires.....	.....do.....		
2	Hub boxes.....	.....do.....		
2	Hub liners.....	Forced into hub boxes.....		
2	Hub rings.....	Outer flanges of hubs.....		
16	Carriage bolts.....	.....do.....		
16	Carriage-bolt nuts.....	.....do.....		
2	Hub bands.....	Screwed on hub boxes.....		
2	Lock washers.....	Between hub bands and hub rings.....		
2	Hub caps.....	On end of hubs.....		
2	Hub latches with rivets.....	Actuate hub-latch plungers.....		
2	Hub-latch springs.....	.....do.....		
2	Hub-latch plungers.....	Lock hub caps in place.....		
2	Oil valves.....	Slide in hub caps.....		
2	Washers (oil valve).....	.....do.....		
2	Springs (oil valve).....	.....do.....		
2	Wheel fastenings.....	At ends of axle.....		
2	Consisting of—			
2	Wheel-fastening plungers.....	.....do.....		
2	Wheel-fastening springs.....	.....do.....		
2	Plugs.....	.....do.....		



# 3 Inch Gun Carriage, Model of 1902.



Side Elevation [Left Wheel Removed]



3 Inch Gun Carriage, Model of 1902.

Plan

Scale: 0 5 10 15 20 25 30 35 40 45 50 Inches

## DESCRIPTION OF THE CARRIAGE.

[Plates IX and X.]

The carriage for the 3-inch gun is of the type known as the long-recoil, in which the gun is permitted a sufficient length of recoil upon the carriage to render the latter stationary under firing stresses. The gun is mounted upon a cradle which forms a housing for the recoil-controlling parts. The cradle rests, and has a small traversing motion, upon the rocker. The latter is journaled upon the axle and its rear end is supported by the elevating mechanism, which is seated in the trail.

The principal parts of the carriage are the cradle (complete), trail, elevating gear, traversing mechanism, elevating and traversing lock, shields, axle seats, ammunition carriers, road brake, and wheels.

## CRADLE COMPLETE.

The cradle receives the gun, guides it in recoil, and forms a housing for the recoil-controlling parts; it consists of a flange steel body bent to a horseshoe shape, with the upper edges flanged outward and connected by a top plate riveted on. The flanges are bronze lined, engage the clips on the gun, and form guides for it in recoil. Riveted to the bottom of the cradle are four steel forgings, the pintle, traversing lug, rear clip, and elevating and traversing lock lug. The pintle fits the pintle socket in the rocker and forms a bearing upon which the cradle is traversed. In normal position, clips on either side of the pintle socket engage projections on the cradle pintle, while the cradle rear clip embraces the rear end of the rocker, locking the two parts together. The cradle is disengaged for dismounting by turning it through an angle of  $38^{\circ}$ . The traversing lug affords a point of attachment for the traversing-link pivot. The cradle rear clip, in addition to embracing the rear end of the rocker, has a broad bearing on the latter directly over the point of attachment of the elevating screw.

To the rear end of the cradle is riveted a steel cradle head, rear, through which the cylinder moves in recoil and projects for attachment to the recoil lug on the gun. The clearance around the cylinder in this opening is closed by a felt washer. The front end of the cradle is closed by the cradle head, front, and retaining ring. The latter bears against the front end of the cradle body and is held in position by two swing bolts, one on each side, pivoted to the cradle. The cradle head has on its outside surface an interrupted collar; the bore of the retaining ring is finished with a ring correspondingly interrupted. A bushing in the cradle head, front, allows the piston to return to its normal position after tightening the piston-rod nut. The cradle head is assembled in the retaining ring with these inter-



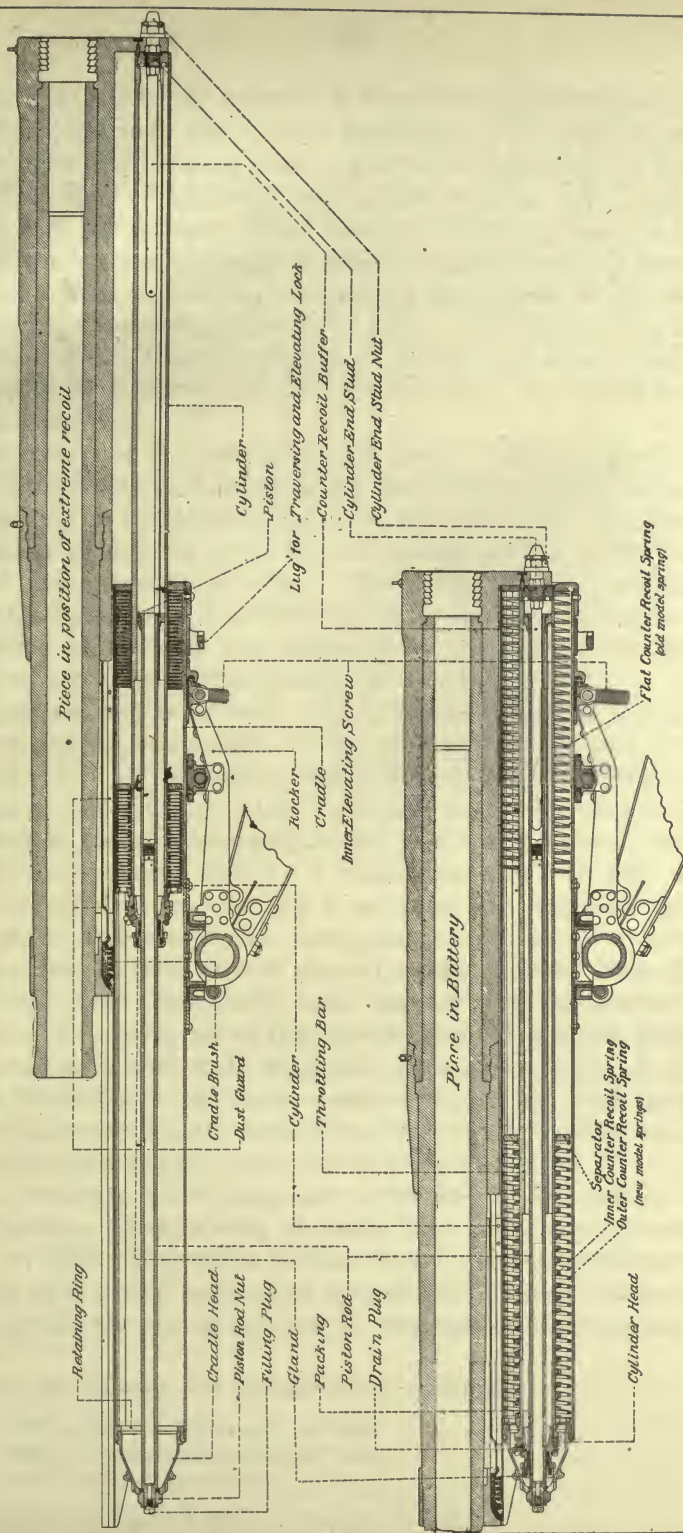
rupted parts interlocking and is held in that position by a hasp. The cradle-head bushing is bored to take the end of the piston rod, which passes through and is secured to it by the piston-rod nut. The retaining ring is so called because it retains the counter-recoil springs in position in the cradle when the cylinder is removed. The cradle head and retaining ring are arranged as described above, so that the head alone or head and ring together may be quickly dismounted to permit access to the parts within the cradle.

The cradle is strengthened on the inside by two bronze pieces called "spring-support guides," placed in the angles of the cradle and riveted to its sides and to the top plate. These pieces are finished with grooves, which receive the guide lugs of the spring support mentioned hereafter, and guide the cylinder in recoil and counter recoil. To the exterior of the cradle are riveted, on the left side, sight-bracket supports for the front and rear sights and fastenings for the shoulder guard; on the right side, a range-quadrant fastening, a firing-shaft bearing in carriages Nos. 1 to 168, and a recoil-indicator guide. All carriages after No. 168 have the firing-shaft bracket seat. On some of the repaired carriages the firing handle bracket seat is an integral part of the cradle head, rear. All of these parts, with others which are riveted to the cradle, are considered integral parts thereof and are included in the designation of "one cradle complete."

The recoil-controlling parts of the carriage (Pl. XI) include the cylinder, piston, counter-recoil buffer, and counter-recoil springs.

The cylinder lies inside of the cradle and is surrounded by the counter-recoil springs. It is a steel tube 72.25 inches long and 2.95 inches outside diameter. Its rear end is closed by a steel cylinder end which is screwed and pinned in place, and is not to be removed in service. The cylinder end is bored through and tapped to take the cylinder-end stud, which projects to the rear through the recoil lug on the gun, to which it is secured by a nut. The rear end of the cylinder-end stud is bored and tapped to permit the attachment of the spring compressor. When assembled to the cylinder, the cylinder-end stud is prevented from unscrewing by a small screw tapped into the cylinder end. When the cylinder is assembled to the recoil lug on the gun, a small pin projects from the front face of the lug into one of five shallow holes bored for the purpose in the rear face of the cylinder and prevents the latter from turning.

The front end of the cylinder-end stud is reduced in size and projects 1.875 inches into the cylinder. To this projection is screwed and pinned the counter-recoil buffer, a tapered bronze rod, which fits with small clearance into the piston-rod bore.



*Recoil Controlling Mechanism*





The front end of the cylinder is closed by a cylinder head screwed into the cylinder to make an oil-tight joint. It should be lashed to the cylinder with copper wire to prevent unscrewing. It is packed with five rings of hydraulic waterproof packing, held by a bronze gland. On the exterior of the front end of the cylinder is a flange which forms a shoulder against which the spring support bears. The cylinder should be held by a wrench on the notches of this flange in assembling or removing the cylinder head. *It should never be clamped in a vise.* A small hole through the cylinder head is provided for the purpose of draining the cylinder for cleaning. It is closed by means of the drain plug.

The interior of the cylinder is cylindrical. Three longitudinal ribs or throttling bars of uniform width but varying height extend from the rear end to within 19 inches from the front end. Notches cut in the piston head form ports for the passage of the liquid from one side of the piston to the other. The height of the throttling bars along the cylinder is calculated so as to make the resistance which the liquid offers, plus the resistance of the springs, constant and such that the recoil will be checked at the desired point.

The piston rod is of steel, and is provided with a bronze head, screwed against a shoulder at the rear end. The head has three notches cut in its perimeter, which fit over the throttling-bar projections on the cylinder walls. The rear end of the piston is bored out to take the counter-recoil buffer. In counter recoil the oil in this bore can escape only by a small clearance. In this way the return of the gun into battery is so eased and regulated that very little shock and consequent derangement of the aim of the piece occurs. The forward end of the rod is also hollow. Near the rear end of this bore three radial holes connect with the interior of the cylinder. The front end of this bore is closed by a filling plug. The piston rod is secured at its front end to the cradle head. A shoulder on the former bears against the cradle-head bushing, while the piston-rod nut is screwed on the rod against the outer face of the head, thus holding the rod against movement in either direction.

The counter-recoil springs are assembled in the cradle around the cylinder. Each spring is made from a rectangular steel bar coiled on edge. The spring column of each carriage consists of three of these coils placed end to end around the cylinder and bearing in front against the spring support, in rear against the rear end of the cradle.

*Issued in place of flat counter-recoil springs:*

Three outer counter-recoil springs.

Three inner counter-recoil springs.

Two bronze separators.

Each spring is made from a square steel bar.

The separators should be assembled between the coils of the springs as indicated on plate. They should be used whenever any of the new outer and inner springs are used, but not between two sections of the old flat springs. In case one flat section spring is to be replaced, the springs should be assembled in the following order beginning at the rear end of the cradle: One outer and one inner spring, one separator, followed by two flat sections. In case two flat section springs are to be replaced, the springs should be assembled in the following order beginning at the rear end of the cradle: One outer and one inner spring, one separator; one outer and one inner spring, one separator, and one flat section spring.

The spring support is a steel ring, which fits over the cylinder and bears against the shoulder at its front end. It has guide lugs which run in grooves in the spring-support guides of the cradle. By this arrangement, in addition to taking the spring pressure, the support affords a centering bearing for the front end of the cylinder and pre-alignment of the piston rod and cylinder as the latter recoils with the gun. When the cylinder is removed, the spring support is held in place by the cradle retaining ring. The spring column is assembled under an initial compression of 750 pounds, sufficient to return the gun to battery at 15° elevation.

#### ACTION OF MECHANISM DURING RECOIL.

The action of the carriage when the gun is fired is as follows: The gun moves to the rear 45 inches on the cradle, carrying with it the cylinder and compressing the counter-recoil springs. The piston rod is attached to a nonrecoiling part of the carriage, so that as the cylinder moves to the rear the oil in it must pass from one side of the piston to the other. The energy of recoil of the gun is absorbed by the resistance which the oil offers to being forced through small openings past the piston and by the resistance of the counter-recoil springs. The energy stored up by the springs returns the gun to its firing position. This return movement is eased and regulated by the counter-recoil buffer. The piston-rod pull and spring resistance are transmitted to the carriage, but owing to its weight and the resistance opposed to the trail spade by the earth the carriage remains stationary.

The length of recoil of the gun upon the carriage is registered by the recoil indicator, a simple friction slide working in the recoil-indicator guide, which is riveted to the right side of the cradle in a convenient position for observation. The slide is actuated by the recoil-indicator throw, attached to one of the recoil-indicator throw hinges on the dust guard, which moves in recoil with the gun. For carriages after No. 168 the forward hinge is used. For carriages No. 1 to No. 168, inclusive, the rear hinge is used. The length of



recoil is read from a scale on the guide, the least reading being 0.25 inch.

The gun may be fired by a lanyard attached directly to the trigger of the breech mechanism, but should habitually be fired by the firing handle on the cradle. The arrangement on *carriages Nos. 1 to 168* for this purpose is as follows: A firing-shaft bearing bracket is riveted to the right side of the cradle near its rear end. The firing handle is mounted upon a bronze firing shaft seated in this bearing. The rear end of the firing shaft is squared and projects into the squared hole of the trigger-arm sleeve seated in the recoil lug of the gun. Pulling the firing handle turns the shaft and sleeve and fires the gun, as described heretofore in connection with the breech mechanism. When released the spring and plunger in the handle returns it to firing position.

*For carriages after No. 168* the arrangement is as follows: A firing-handle bracket seat is riveted to the right side of the cradle near its rear end. On some of the carriages the firing-handle bracket seat is an integral part of the cradle head, rear. The firing handle is mounted upon a steel firing shaft seated in a firing-handle bracket, the whole being held by two studs on the bracket seat. The rear end of the firing shaft is squared and projects into the squared hole of the pallet shank seated in the recoil lug of the gun. Pulling the firing handle turns the shaft and shaft trip collar till the head of plunger hits the adjusting screw, which forces the plunger and the latch upward and releases the trip latch from the trip collar. The shaft-return spring returns the shaft to firing position; the handle-return spring returns the handle to its normal position. The firing handle is of the folding type and has a projection which seats in a slot in the handle bracket. Care should be taken in assembling the handle and shaft-return springs, which are wound right and left hand. The shaft-return spring is left hand and is assembled in the rear of the bracket with the short end of the spring in the lower slot of the bracket. The handle-return spring is right hand and is assembled in the front of the bracket with its short end in the top slot of the bracket.

#### \* TRAIL.

The trail consists of two steel flasks of channel section with the flanges turned inward, tied together by transoms and plates, as described below. To the front end of each flask is riveted a forged-steel axle bearing, split so as to be slipped over and secured to the axle by clamping bolts. Near the forward end, riveted to the flasks, are the front and rear elevating-gear transoms. Between these two transoms, bolted to and supported by them, are two elevating-gear transoms (middle) which form a seat for the elevating gear.



In rear of the elevating-gear transoms are the front and rear tool-box transoms. Between these the trail is provided with a bottom, to form a tool box, which is closed by a hinged lid secured by a spring-handle catch. The portion of the trail between the rear end of the tool box and the wheel-guard transom is formed into a box for the transportation of the rear-sight shank. This rear-sight box is fitted with suitable packing to hold the sight shank in place, and has a lid arranged to be secured in closed position by the tool-box lid and fastening. A padlock, attached by a chain to the left flask, serves to lock both boxes.

The portion of the trail in rear of the sight-box lid is closed by a top plate, riveted on. The flasks at the points of contact of the limber wheels when making short turns are protected by small plates called wheel guards, and are strengthened by the wheel-guard transom. The rear ends of the flasks are flanged outward to give a firm bearing and support to the spade in which the trail terminates.

The spade consists of a piece of flange steel placed crosswise of the flasks and riveted to their flanged ends. Its ends are supported and stiffened by being turned back at right angles to its bearing surface and riveted to the float plate. The latter is also riveted to the upper flanges of the flasks. The wings of the float project on either side of the spade to give sufficient bearing to prevent the end of the trail from burying itself in the ground. A hardened-steel spade edge is riveted to the lower edge of the spade.

A lunette bracket and a handspike fulcrum are riveted on the float. The lunette is a steel ring with a stout shank, which passes through a lug in the bracket and is secured in place by a nut, being thus attached so as to be easily replaced when worn.

The handspike is of the folding type. When not in use it is turned over on the trail and held by a spring fastening riveted to the top plate. Two trail handles are riveted to the upper side of the float.

Two seats for cannoneers serving the piece are rigidly attached to the trail, one upon each side, in a convenient position.

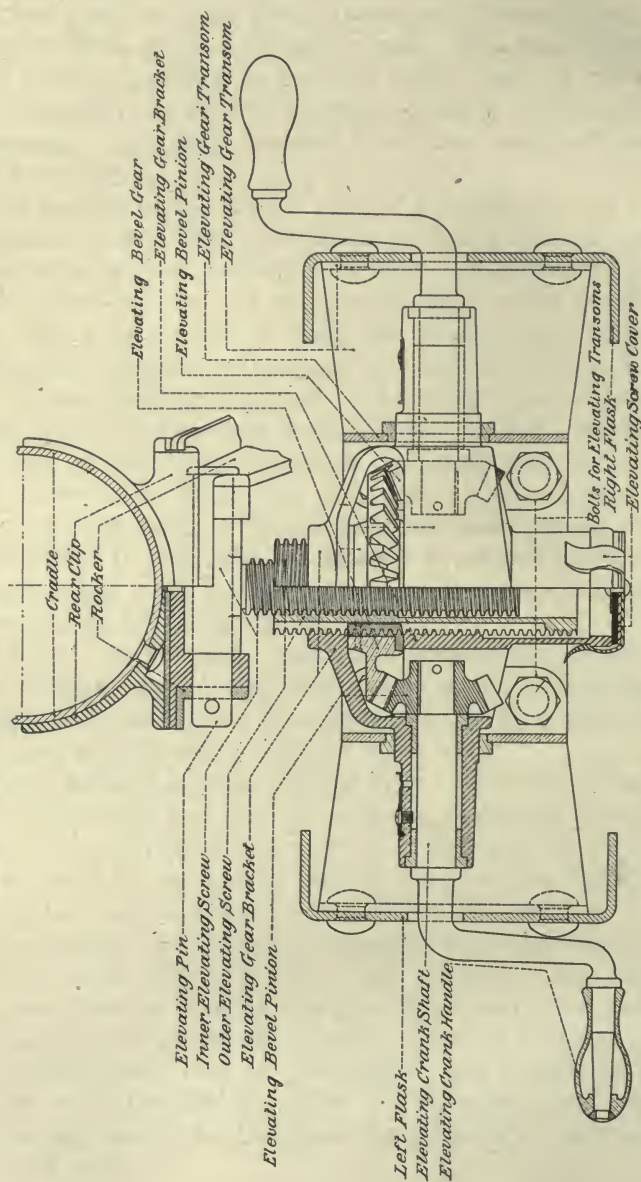
Attachments for carrying the sponge and rammer are provided on the right flask. On the later carriages the sponge and rammer fastenings are placed so that the sponge end is toward the rear.

A name plate giving the number, name of carriage, model, name of manufacturer, year of completion, and initials of inspector, is riveted to the tool-box top plate. *In all reports and correspondence the carriage should be designated by the number and model given on the name plate.*

#### ELEVATING GEAR.

The elevating gear (Pl. XII) is of the double-screw type, and consists of an inner and outer elevating screw, an elevating-gear bracket,





*Elevating Gear Half Elevation and Half Section*

Scale: 0 1 2 3 4 5 6 Inches



an elevating bevel gear, two elevating bevel pinions, and two elevating crank shafts. The inner elevating screw is a steel screw, threaded with a right-hand thread. It is attached at its upper end by the elevating pin to the rear end of the rocker. The outer elevating screw is of bronze and is threaded on the exterior with a left-hand thread, while the bore is threaded with a right-hand thread to take the inner elevating screw. On the exterior are also cut two longitudinal keyways, in which the keys of the bevel gear work.

The elevating-gear bracket is bored out and threaded to take the outer elevating screw, and is provided with two trunnions which rest in bearings in the elevating-gear middle transoms of the trail. These trunnions are bored and bushed to form bearings for the elevating crank shafts, of which there are two, one on each side of the trail. A steel pinion is pinned and keyed on the inner end of each crank shaft and meshes with a bronze bevel gear mounted on the outer elevating screw in a seat slotted through the gear bracket. The bore of the bevel gear is finished with two steel keys which fit into the keyways in the outer screw. This arrangement causes the outer screw to rotate with the bevel gear and at the same time permits it to move longitudinally through the bevel gear.

As will be seen from Plate XII, the revolution of the crank handles rotates the pinions and through them the bevel gear. The outer screw turns with the latter and moves up or down in the elevating-gear bracket according to the direction of rotation. The inner screw is prevented from rotating by its attachment to the rocker, and on account of the direction of its threads moves into or out of the outer screw as the latter is screwed into or out of the gear bracket. An elevating-screw cover is attached by spring clips to the lower end of the bracket to exclude dust from below. In traveling the elevating gear should be run to the position of maximum elevation to house the screws in the elevating-gear bracket. In this position, when properly assembled, the top of the outer screw and the end of the threaded portion of the inner screw are flush with the face of the gear bracket. The mechanism is designed to give a maximum elevation of  $15^{\circ}$  and a maximum depression of  $5^{\circ}$ .

The rocker is the intermediate part between the upper carriage, or cradle, and the lower carriage, or trail. It forms a platform upon which the cradle is moved in azimuth, and moves with the cradle relatively to other parts of the carriage in elevation. It is built up of an angle, formed into shape, to which three steel forgings—the pintle socket, traversing-gear case, and traversing plate—are riveted. Its front end is supported by the portion of the axle between the flasks; it is assembled by inserting the axle through two bronze-bushed holes in the pintle socket when the trail is assembled on the axle. The upper portion of the pintle socket is formed into a bronze-lined

socket and bearing surface for the cradle pintle, and is provided with two clips to take corresponding parts of the latter. The rear end of the rocker terminates in the traversing plate, bronze lined to form a bearing for the cradle rear clip. The lower side of the traversing plate is finished to take the head of the elevating screw, to which it is secured by the elevating pin. The traversing-gear case, which forms a housing for the traversing mechanism, is riveted to the rocker angle in front of the traversing plate.

#### TRAVERSING MECHANISM.

The traversing mechanism (Pl. XIII) consists of a shaft, called the traversing shaft, mounted in bearings in the traversing-gear case, and a traversing nut moving longitudinally on the shaft, but restrained from turning with it by its bearings in the gear case. A cylindrical lug on top of the nut fits in a hole in a bronze traversing link, the right end of which is pivoted by the traversing-link pivot to the traversing lug on the under side of the cradle. This pivot is secured to the cradle-traversing lug by a nut and split pin. The left bearing of the traversing shaft is split for the purpose of assembling and rests between two collars on the shaft. The bearing with the shaft in place is slipped into its seat in the gear case, where it is held in position by two pins.

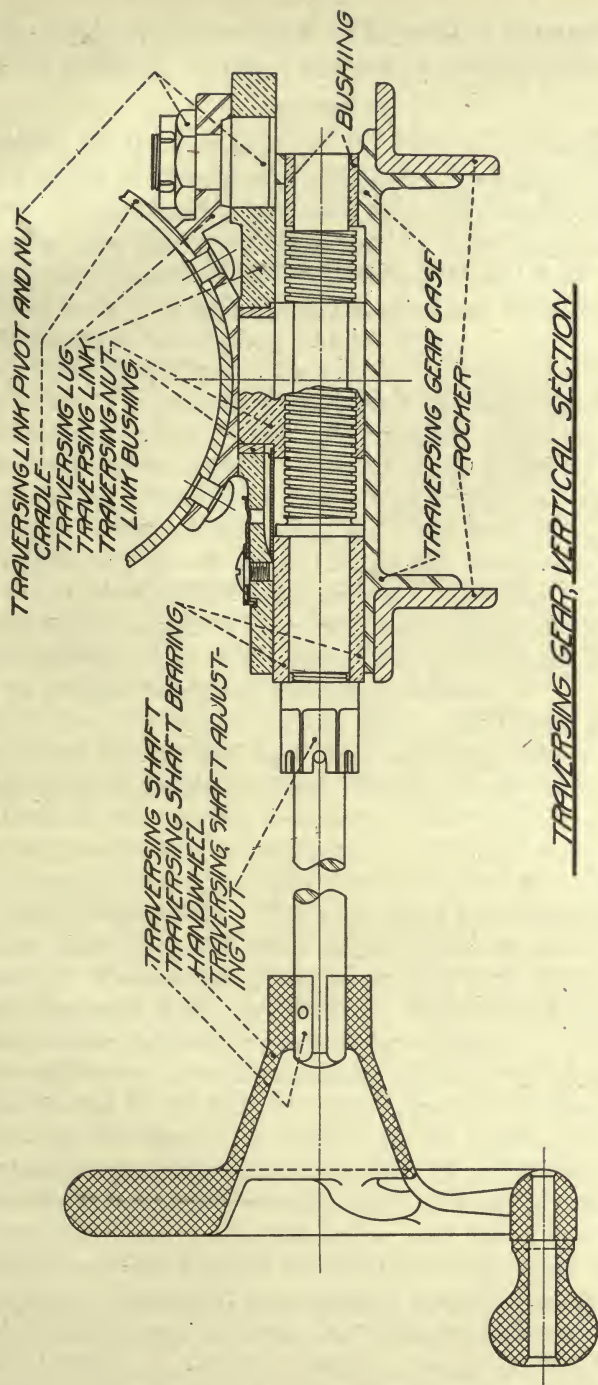
*For new work and repairs.*—The traversing-shaft bearing is made in one piece. One of the collars on the shaft has been removed, in order that the bearing may be slipped in position on the shaft. The shaft is threaded to take a traversing-shaft adjusting nut. Two (special) taper pins hold the bearing in position.

The traversing shaft extends to the left of the rocker and terminates in a traversing handwheel. When the handwheel is turned the screw threads of the shaft compel the nut to move along it, since the nut is prevented from rotating by its bearings in the gear case, and longitudinal motion of the shaft is prevented by its left bearing. The motion of the nut is communicated through the link to the cradle; the amount of motion thus provided for is 140 mils, 70 on each side of the axis of the carriage. An azimuth scale riveted to the rocker and a pointer attached to the cradle show the position of the gun in azimuth; the scale is graduated to a least reading of 5 mils.

#### ELEVATING AND TRAVERSING LOCK.

To relieve the pointing mechanism from all strains in traveling, an elevating and traversing lock is provided, by which the cradle may be securely locked to the trail. This lock consists of a stout hook hinged to the rear elevating-gear transom in such a position as to engage the elevating and traversing lock lug riveted to the under





TRAVERSING GEAR, VERTICAL SECTION







side of the cradle at its rear end. The hook is arranged to be held in either the locked or unlocked position by a steel spring.

#### THE SHIELDS.

The shield for the protection of the crew is an armor plate, 0.15 inch thick, made in three parts—the apron, the main shield, and the top shield. These shield plates were originally made 0.2 inch thick, and in order that the new shields may be interchangeable with the older ones, four bracket-fastening filler pieces and four apron-hinge filler pieces, each 0.05 inch thick, are provided with the new shield for all carriages to which they may be fitted.

The apron is hinged under the axle and reaches to within 5 inches of the ground. For traveling it is swung up under the ammunition-carrier tubes and is held by two apron latches, which are attached to brackets riveted to the tubes. The main shield is rigidly attached by bolts to the bracket fastenings and to lugs on the trail-axle bearings, and is braced by two shield braces reaching from its upper corners to the ammunition-carrier tubes. It has two wing nuts for securing the top shield when folded down, and has a sighting port and a gun port. The latter is made a minimum port and the shield is stiffened by a hood riveted to its front face. The main shield reaches from the axle to 4 inches below the tops of the wheels.

The top shield is hinged to the main shield, has a panoramic sight port and is provided with two fastenings which secure it in either the raised or folded position. The upper edge of the top shield is 62 inches from the ground, sufficient to afford protection from long-range or high-angle fire to cannoneers on the trail seats.

The panoramic and open sight ports are provided with shutters, hinged to the main shield. The open sight port shutter has a support which bears upon the main shield and holds the shutter in an open position. The shutter of the panoramic sight port, when open, rests upon the open sight port shutter. When closed the panoramic sight port shutter is held in position by a latch.

For the protection of the cannoneer sighting the gun a shoulder guard is attached to the left side of the cradle at the rear end. The fastenings for the guard are riveted to the cradle, but the guard itself is detachable and is secured in place by a steel pin.

A sheet-steel box, with leather-lined packing blocks called the "panoramic-sight case," attached to the rear face (left side) of the main shield, provides a place for the panoramic sight in traveling. This box has a hinged lid, secured by a hasp and wing nut, and is provided with the usual padlock with chain for locking the box. The sight-case bracket is fastened to the shield by five bolts. The sight case is supported between springs compressed between supports on the bracket and held in place by bolts acting as spring rods.

The mounting is thus such that the sight is well protected from injury due to shocks and jars.

A similar case, called the range quadrant case, is attached to the right side of the main shield by means similar to those just described and is provided for the safe transportation of the range quadrant.

A sheet-steel dust guard, assembled on the cradle between the locking hoop and clip of the gun, covers and protects the guide rails from dust and dirt. The dust guard is fitted at its forward end with a bristle brush and felt wiper, which sweep the upper surface of the cradle at each stroke of recoil and counter recoil.

All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes closed by spring covers or handy oilers.

#### AXLE SEATS.

Each axle seat and each pair of ammunition-carrier tubes is supported by two steel bracket fastenings, which are secured upon the axle by bolts and are prevented from turning by the axle keys. A steel plate, called a "tube-support plate," perforated with two flanged holes, is bolted to these bracket fastenings. Two plate angles are riveted to the tube-support plate in order to make it more rigid. Two 4-inch steel tubes are riveted to the flanges of these holes and project to the front, where their ends are riveted to a brake-beam tube and fashioned to form a foot rest for the cannoneers. This brake-beam tube is fitted to form fulcrum and guide bearings for the road brake beams. The forward ends of the ammunition carriers are braced by tie-rods from the lower side of the axle bracket fastenings and by a shield brace to the shield and the upper ends of the seat arm and seat-arm support.

An apron-latch bracket is located between each pair of ammunition tubes and firmly riveted to them. The apron-latch body is pivoted on a block bolted to this bracket; the lower end of the latch body is formed into a hook which engages a latch staple riveted to the apron shield and holds the latter in its traveling position. To prevent accidental disengagement of the hook from the staple, the opening of the hook is closed by a plunger seated in the latch body and pressed outward into action by a coiled spring. An apron-latch lever is provided for withdrawing the plunger from the hook opening when it is desired to disengage the hook from the staple.

The axle seats, formed of flange steel, are bolted at the rear to the tube-support plate; at the front it is supported by the seat support, the two ends of which are bent back and bolted to the axle bracket fastening. Each seat is provided with a wheel guard, formed of two small steel tubes, called the "seat arm" and "seat-arm support,"



and of a sheet-steel piece, called the "seat-arm guard," secured to the seat arm and the shield brace. The top shield, folded down for traveling, serves as a back rest for the cannoneers on the axle seats.

#### AMMUNITION CARRIERS.

The ammunition carrier tubes project to the rear over the axle and under the seat, and are fitted inside with bearings to take each a round of ammunition. Their rear ends are closed by a hinged cover secured by a spring latch.

#### ROAD BRAKE.

The brake beams are pivoted on fulcrum pins in bearings in the brake-beam tubes at the front ends of the ammunition carriers. Cast-iron brake shoes are attached by tap bolts to the outer ends of the beams. To their inner ends are pinned brake rod ends, into which the brake rods are screwed. The brake-rod spring slips over the rear end of the brake rod and abuts against a shoulder upon it. The spring is covered by a tube called the "spring cover," inclosed at each end by bronze pieces, called the "spring-cover head" and "spring-cover end." The spring is compressed between the spring-cover end and the shoulder on the brake rod, while the rod is arranged to have a short longitudinal movement against the pressure of the spring. The spring-cover ends are pinned to cranks on squared ends of the brake shaft, which is mounted in lugs projecting to the front from the trail axle bearings. The brake lever (which serves as the crank at the right end of the shaft) is double, one arm projecting to the rear through a slot in the main shield, while the other is conveniently placed for use from the right axle seat. When the brakes are set, the lever is held by engaging in the teeth of the rack on the brake segment. The latter is a flange steel piece, with a flange in which are riveted two hardened tool-steel racks, riveted to a brake segment bracket, which is clamped and keyed to the axle. The levers are made of spring steel. Adjustment to compensate for wear of the brake shoes is provided for by the distance which the brake rods are screwed into the brake rod ends. The tension of the brake rod spring is regulated by screwing the spring-cover end into or out of the spring cover, thus shortening or lengthening the spring space in the cover. The brake is to be used as a firing as well as a road brake.

#### THE WHEELS.

The wheels are a modified form of the Archibald pattern, 56 inches in diameter, with 3-inch tires. The hub consists of a forged steel hub box and hub ring assembled with eight carriage bolts through the flanges and with a bronze hub cap screwed on the outer end of the hub box. The hub band is screwed on the hub box. A lock washer is placed between the hub ring and the hub band, preventing the latter from unscrewing. The hub band should be screwed up as

tightly as possible with the wrench and finally forced by striking the end of the wrench with a wooden block or mallet. The bronze hub cap is screwed on the hub box and is locked with the hub-latch plunger, which is withdrawn and held in the disengaged position by the hub latch when the hub cap is to be unscrewed. Assembled to the hub cap and projecting into the axle arm is an oil valve, through which the wheel is oiled without removal. The hub box is fitted with a bronze liner, forced into place. The liners are removable. The tire is shrunk on and secured to the felloe by eight tire bolts.

The wheel fastening consists of a bronze yoke fitting in the outer end of the axle arm and is accessible when the hub cap is removed.

The axle is hollow and forged from a single piece of steel; the keys, solid with the axle, hold the axle bearing, bracket fastenings, and segment bracket in their places.

The axle arms make an angle of  $1^{\circ} 11.5'$  with the axle. This brings the lowest spoke of each wheel vertical.

#### DISMOUNTING AND ASSEMBLING GUN AND CARRIAGE.

*To remove the recoil indicator.*—The ends of the clips of the recoil-indicator guide are bent down to form stops to hold the indicator in place. To remove the indicator, these parts are opened up sufficiently to permit sliding the indicator out of the guide. When the indicator is assembled, these clips should always be closed down to prevent its loss.

*To dismount the gun.*—Remove the recoil-indicator throw, unscrew the cylinder-end stud nut, and shove the gun to the rear until the clips are free from the guides.

*To mount the gun.*—Shove the piece from the rear over the cradle guides with the clips engaging the guides. Assemble the cylinder-end stud nut, taking care that the locking stud on the recoil lug enters one of the recesses provided for it in the end of the cylinder. Assemble the recoil-indicator throw. The dust guard should be assembled with the gun.

In moving the gun on or off of the cradle particular care must be taken to support the breech end so that the gun clips remain in line with the gun slides. The firing shaft is also quite liable to injury during this maneuver, and care should be taken to prevent its being struck by the muzzle of the gun or by implements in the hands of the cannoneers. The cradle should be placed at the desired elevation and azimuth before beginning either of these maneuvers and not changed during its progress, since the working of either the elevating or traversing mechanisms when the gun is only part way in battery brings an excessive and unnecessary strain and wear upon those parts.

*To dismount the cylinder.*—Bring the gun to approximately zero degrees elevation; unscrew the cylinder-end stud nut and the piston-



rod nut; remove the cradle head front. The cylinder is now free and may be pulled out to the front.

*To assemble the cylinder.*—The springs and retaining ring being in assembled position, shove the cylinder (turned so that the drain plug in cylinder head comes on top) into its seat from the front, with the projecting stud on the recoil lug of the gun entering one of the recesses provided for it in the cylinder end; assemble the cradle head; screw in place the piston-rod nut and cylinder-end stud nut.

*Be sure that the projecting stud on the gun enters one of the holes for it in the cylinder end before screwing the cylinder-end stud nut up all the way.*

*To dismount the springs.*—Bring the gun to approximately zero degrees elevation; unscrew the cylinder-end stud nut and the piston-rod nut; shove the gun about 1 inch from battery; attach the sleeve end of the spring compressor to the cylinder-end stud and put sufficient strain on the compressor to relieve the retaining ring from spring pressure; then remove retaining ring (and cradle head) by loosening and swinging aside the retaining-ring bolts; ease off on the spring compressor until the springs are free.

*To assemble the double counter-recoil springs.*—With the cradle at maximum elevation and the trail horizontal, place one outer and one inner spring in the cradle until the front ends are about 2 inches in; set up a separator against the forward end of these sections and enter the second outer and inner springs, keeping the separator upheld between the sections; similarly when the outer end of the second section is 2 inches inside the cradle set up the second separator; place the third outer and inner sections on the recoil cylinder. Screw the spring centering tool onto the cylinder-end stud, the small end pointing rearward; pass the sleeve end of the spring compressor through the gun lug and the inner springs and attach it to the cylinder-end stud. Enter the rear end of the cylinder in the spring at the front end of the cradle and push the cylinder back until the springs are at free height, keeping the spring compressor taut. Attach the block and fall carried in the battery wagon to the spade of the carriage or to some improvised support and connect it to the spring compressor; put sufficient strain on the spring compressor to bring the spring column to its assembled height.

As the spring column approaches its assembled height the spring support must be turned so that its guide lugs properly enter in the spring-support guide grooves in the cradle; assemble the retaining ring, disconnect the spring compressor and the spring centering tool from the cylinder-end stud; push the gun back into battery and assemble the cylinder-end stud nut. When the retaining ring is assembled the nuts for the retaining ring bolts should be screwed up until they just come into contact with the retaining ring. If these nuts are screwed up too tight they will deform the retaining ring,



with the result that it becomes difficult to assemble and dismount the cradle head. A wrench is provided for turning the spring support to its proper position.

*To assemble the single counter-recoil spring.*—The same method is followed except that no separators are used. The spring compressor is provided with a second eye at its large end which may be used in case the sleeve end should become broken; in case this end is used, however, it will be necessary to pass the compressor through the cradle from front to rear, through the gun lug. For disconnecting the compressor the method used is identical to that previously described.

The cylinder-end stud nut should never be removed when the gun is at an elevation, and the gun should not be elevated when the cylinder-end stud nut is not in place. To prevent the cylinder-end stud from rotating a screw for the cylinder end is provided. *This screw for the cylinder end must be removed before attempting to unscrew the cylinder-end stud.*

The springs are assembled under an initial load of over 750 pounds; a pull of more than 750 pounds must therefore be exerted upon the spring compressor in assembling them. This can be done by passing a handspike through the loop at the rear end of the compressor and making use of the services of the entire gun crew, or the block and tackle may be used as described above. To avoid the possibility of injury to the gun crew in compressing or releasing the springs, all should be required to keep arms and bodies away from the front of the spring column during these operations.

*To fill the recoil cylinder.*—If the cylinder is not completely filled, loss of stability will occur and higher stresses than normal will be developed in the carriage; for this reason the cylinder should be filled with the greatest care; a commissioned officer should himself verify that the cylinder is full and that no air is left in it, with the exception of the void noted below. The easiest way to fill the cylinder is when it is disassembled from the carriage. If assembled to the carriage bring the gun to its maximum elevation and remove both filling and drain plugs. It is necessary that the drain-plug hole should be located on top of the cylinder. Fill through the hole in the piston rod. Allow a few minutes for the air to escape and the oil to settle. Refill and repeat two or three times. When satisfied that the cylinder is entirely full of oil, insert both plugs, and depress the gun to its maximum depression. After a few minutes elevate again to maximum elevation and unscrew both plugs. Now refill as described above. When entirely full allow not more than 2 cubic inches (about one-fourth of a gill) of the oil to escape; insert both plugs and lash them with copper wire.

It may happen that after firing a few rounds the gun will not return to battery. This may be due to, first, weakness of springs;

second, stuffing-box gland being screwed up too tightly; or, third, the oil having expanded, due to heat.

In either case the cause must be ascertained and remedied; if due to expansion of oil it is proven by the fact that the gun can not be pushed into battery by force exerted on the breech of the gun. In that case elevate the gun to its maximum elevation and remove the filling plug. The oil will now escape, permitting the gun to return to battery.

About 9 pints of oil are required for filling the recoil cylinder. Hydroline oil of a specific gravity of 0.85 is furnished by the Ordnance Department for use in these cylinders; it is characterized by its low freezing point and by its noncorrosive action on metals. The oil used in the cylinder should be clean and free from grit and dirt; to insure this it should be strained through a clean piece of linen or muslin before using. In emergencies water may be used in the cylinder. *This should be done only when absolutely necessary, and never in freezing weather, and as soon as practicable the cylinder should be emptied, cleaned, and thoroughly dried and filled with hydroline oil.*

*To pack the stuffing box.*—The stuffing box is packed with five rings of Garlock's hydraulic waterproof packing, 0.25 inch square. The packing is issued cut into rings of such size that the ends meet around the piston rod. The latter being assembled, each ring, placed so as to break joints with preceding one, is forced in succession into its seat by a packing tool of copper or hard wood, one end of which is shaped like a carpenter's gouge and the other end forms a handle strong enough to stand light taps from a hammer. Such a tool may be readily improvised by the battery artificer. After the five rings are firmly seated in the box, screw the gland down on the packing.

In assembling the gland be sure that *at least four* of its threads are engaged with the threads of the cylinder head; otherwise the threads of the gland may be stripped in firing. With new packing it may be found difficult to insert more than four rings and secure sufficient engagement of the gland. In such a case the box should be packed with four rings and the piece fired a few rounds, after which the fifth ring should be inserted.

*Adjustment of the gland.*—The adjustment of the gland will require the exercise of some judgment. If screwed up too tight, the frictional resistance of the packing on the piston rod will be so much increased that the counter-recoil springs may fail to return the gun to battery, especially at high angles of elevation. *It should be screwed up just tight enough to prevent the leakage of oil through the stuffing box.* Ordinarily this can be done by hand, but in cases where hand power is not sufficient the wrench provided for the pur-



pose should be used. When its proper adjustment is determined, the gland should be lashed with copper wire to prevent it from screwing up or unscrewing.

*To remove the piston rod.*—Unscrew the gland sufficiently to release the pressure of the packing upon the rod; unscrew and remove the cylinder head. The rod may then be withdrawn from the cylinder. In dismounting and assembling the cylinder head (and also the cylinder-end stud), the cylinder should be held from turning by a spanner applied to the head retainer or flange on the front end of the cylinder. *It should never be clamped in a vise*, as its walls are thin and not intended to withstand such usage.

*To remove the counter-recoil buffer.*—Remove the cylinder-end stud screw; unscrew and remove the cylinder-end stud; the counter-recoil buffer is attached to the latter.

The necessity for dismounting parts of the cylinder will seldom arise. It should be done only in the presence of a commissioned officer, who should see that the parts are handled with the greatest care. In assembling, the parts should be thoroughly cleaned, as the clearances in the cylinder are very small, and the presence of small foreign particles may interfere with the proper working of the assembled parts. The cylinder head should be set up hard with a wrench and then lashed with copper wire to prevent unscrewing.

*To dismount the traversing mechanism.*—Traverse the cradle (muzzle end) to its extreme left position; remove the nut which secures the traversing-link pivot to the cradle lug; remove the traversing-link pivot from below; turn the link so as to clear the heads of the traversing shaft-bearing pins and remove these pins; unscrew the worm shaft from the nut and at the same time withdraw the shaft with its left bearing from the gear case. Now move the cradle in azimuth to its extreme right position; slip the link off of the nut and remove the nut from the gear case. To dismount the left bearing of the shafts equipped with the adjusting nut and one piece bearing, all that is necessary is to remove the adjusting nut and slip the bearing off the shaft. To assemble the traversing mechanism, the above operations are reversed. In certain carriages of earlier manufacture (Nos. 1 to 10 and 19 to 26, inclusive, Rock Island Arsenal) the foot rest at the front end of the ammunition tube prevents the cradle from being traversed far enough to the right to permit the removal of the traversing-link by the method just given. For such carriages the traversing-link pivot, traversing shaft, and traversing-shaft bearing may be dismounted as stated, but the right ammunition carrier must be removed from the carriage before the cradle can be traversed far enough to permit the removal of the link.

*To dismount the elevating screws.*—Remove the elevating pin; unscrew the inner screw by hand; remove the elevating-screw cover;



remove the outer screw by screwing it down through the elevating-gear bracket.

*To dismount the pinions and bevel gear.*—Remove the taper split pin in the pinion hub, after which the crank shaft may be withdrawn and the pinion removed from its seat. The bevel gear may then be removed by dismounting the screws as above.

*To dismount the elevating-gear bracket.*—Free the mechanism from the rocker by removing the elevating pin; dismount the pinions and crank shafts as above; remove the eight elevating-gear transom bolts; the bracket and transoms are then free and may be removed from the trail.

*To assemble the elevating mechanism.*—The operations just described are reversed. The following should be noted: The pinions are a close fit on the crank shafts, and especial care should be taken not to burr the parts in assembling. When properly located, the two crank-shaft handles balance each other. This condition obtains when they are simultaneously horizontal and both pointing to the front or both pointing to the rear. As the outer screw is assembled in the gear bracket from below, the bevel gear should be put in place with its key engaging the keyways of the screw. Before attaching the inner screw to the rocker both screws should be run down to be sure that the upper ends of the threaded parts of the screws are flush with the face of the gear bracket. If this condition is not fulfilled the mechanism will not give the maximum elevation and depression for which designed and will not house properly in traveling.

*To remove the shields.*—The main shield is freed from the carriage by removing the bolts which secure it to the bracket fastenings, axle-bearing lugs, and shield braces. The apron is detached by removing the apron-hinge pins.

*To remove the apron latch.*—Remove the bolt which secures the apron-latch block to the bracket riveted to the ammunition tubes. The block, with latch, can then be slipped to the front, clear of the bracket.

*To dismount the cradle.*—Remove the traversing gear (it will suffice to remove the traversing-link pivot and to remove the handwheel from the traversing shaft); remove the three shield bolts and shield-brace bolt; slip end of shield brace from tie-rod fastening; raise the right axle seat (and for carriages of earlier manufacture, as Nos. 1 to 10 and 19 to 26, R. I. A., the right ammunition carrier) as described below; swing the rear end of the cradle  $38^{\circ}$  to the left, and then lift it clear of the carriage.

*To remove the road brake.*—The brake rods are dismounted by removing the brake-rod pins which attach the front ends of the rods to the brake beams and the rear ends to the brake crank and the brake lever.

The brake-beam fulcrum pins are removed by driving them upward out of their seats; the brake beams are then free and may be removed from the carriage; the brake shoe is freed from the beam by unscrewing the brake-shoe tap bolts.

The brake crank may be slipped off the left end of the brake shaft after removal of the split pin. The brake lever is dismantled by moving the brake shaft a short distance to the left through its bearings; by a continuation of the movement to the left the brake shaft is removed from the carriage.

The brake segment is dismantled by removing the segment-bracket clamping bolt and slipping the bracket off of the axle (the right ammunition carrier having first been dismantled as described below).

*To assemble the road brake.*—The operations just described are reversed. The following should be noted: The brake beams, with shoes attached, are rights and lefts, and are properly assembled when the shoe has a full bearing upon the tire. Reversing the shoe upon the beam changes the combination from a right to a left, or vice versa. The brake crank when correctly assembled on the brake shaft is parallel to the crank end of the brake lever. The tension of the brake rod spring is regulated by removing the split pin, which passes through the spring cover, and screwing the spring-cover end into or out of the spring cover. The tension of the spring is increased by screwing the end into the cover. The length of the brake rod should be adjusted by screwing the front end of the rod into or out of the piece attaching the rod to the brake beam.

*To adjust the road brake.*—The brake rods are disconnected from the brake beams. The brake shoes are placed with the clearance from the tire desired and the brake lever with handles in extreme forward (released) position. The length of the brake rods should then be adjusted to correspond. Should test show that one shoe bears harder on one wheel than the other, the brake rod of the latter should be lengthened.

*To remove a hub liner.*—Remove the wheel from the axle and drive the liner out by striking with a heavy hammer or sledge upon the hub-liner driving tool (a bronze tool carried in the forge limber) placed against the small end of the liner.

*To remove a wheel.*—First remove the hub cap, then the wheel fastening, and then the wheel.

*To remove a hub cap.*—First lift the hub latch which removes the hub-latch plunger from the hub band and then unscrew the hub cap by turning it to the left.

*To remove a wheel fastening.*—First lift the wheel-fastening plunger until it is clear of the axle and then lift the wheel fastening off of the axle.

*To remove the axle seats and ammunition carriers.*—The wheels, wheel fastenings, and shields having been dismantled, remove one of



the brake rod pins to free the brake beam; then remove the bracket-fastening clamp bolts and slip the bracket fastenings, with axle seats and ammunition tubes attached, off of the axle.

*To remove the axle seats.*—It is sometimes desired to remove the axle seat without the ammunition carrier, and thus avoid dismounting shields and wheels. This may be done by removing the three bolts which hold the rear edge of the seat proper, the two special bolts which hold seat support in bracket fastening, the bolt at the upper end of the shield brace, and the tie-rod fastening nut at the lower end of the shield brace. The seat, with seat support, seat arm, seat-arm support, seat-arm guard, and shield brace attached, is then free and may be removed from the carriage.

*To dismount the trail and rocker.*—The wheel, wheel fastening, shields, axle seat, etc., having been removed as described above, remove the axle-bearing bolts and slip trail and rocker off the axle.

The parts of this carriage in general are made with sufficient clearance to permit of the assemblage of any part without the use of force. In assembling them no part should be directly struck with a hammer. If resort to force is necessary, a piece of wood or copper should be interposed between the hammer and the part struck. All nuts are provided with split pins as keepers. The split pin must, of course, be removed to remove the nut, and when the nut is assembled the split pin should be inserted and properly opened. Certain parts are lashed with wire to prevent unscrewing. A spool of copper wire is provided in the tool box for this purpose. A pair of wire-cutting pliers is also provided for use in pulling split pins, cutting wire lashings, etc.

#### CARE AND CLEANING OF RECOIL CYLINDERS AND OTHER PARTS OF CARRIAGE.

The carriage must be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the methods of mounting and dismounting the various parts, and should see that the carriage is properly handled, cleaned, and cared for. The following general directions for its care and cleaning are given:

The recoil cylinder should be emptied and refilled once every three months, and thoroughly cleaned once every six months, or oftener if the conditions require it. The cylinder is most readily emptied and filled when removed from the carriage. For cleaning it is dismounted and the cylinder head, counter recoil buffer, and piston rod removed, as heretofore described. The interior of the cylinder, the piston, the counter recoil buffer, and the stuffing box should then be thoroughly cleaned by the use of cotton waste and coal oil and wiped dry with cotton waste. The removal of the packing is not



necessary in cleaning. The cylinder bore should be carefully inspected, and if any rust has formed it should be removed with coal oil, using, if necessary, *fine* emery cloth. The latter must be used with great care to prevent any increase in the clearance between the cylinder and piston. If rubbing, burring, or scoring of the parts is noted, the rough spots should be carefully smoothed down by a skilled workman with a dead-smooth file or with emery cloth, and the cause of the roughness ascertained and removed. Where unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department charged with the duty of keeping the battery in repair for his information and action.

The parts should be reassembled immediately after cleaning and inspection, and the cylinder filled with the hydroline oil issued for that purpose. The piston should be moved back and forth in the cylinder by hand to make sure that all parts are correctly assembled and are without interference. The cylinder should then be mounted in the carriage and the gun pulled from battery by hand and permitted to counter recoil rapidly to insure that all parts are in proper position for firing. *This should never be done, however, unless the cylinder is known to be filled with oil.* In reassembling the parts the condition of the vulcanized-fiber washers between cylinder head and cylinder and cylinder-end stud and cylinder end should be noted; they should be replaced whenever necessary to prevent leakage. In removing and inserting the piston rod care should be taken to keep it central in the cylinder, so as not to bind, burr, or spring any parts. *The dismounting and reassembling of the parts of the cylinder should in every case be supervised by a commissioned officer.* Before firing, an inspection should be made to ascertain that the different parts, especially the piston rod and cylinder-end stud nuts, are correctly assembled.

The recoil-cylinder oil should be stored in the closed cans provided for the purpose, and be carefully protected from dirt, sand, or water. Oil withdrawn from cylinders and containing any sediment must not be used again until it has been allowed to settle for not less than 24 hours. When sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the oil. To insure the cleanliness of all cylinder oil it should be strained through a clean piece of linen or muslin before using.

The exterior of the cylinder should be kept well oiled and free from rust or dirt, and an inspection made at least once each month to ascertain its condition. Where rust has formed it should be removed with coal oil and, if necessary, emery cloth. For shipment or storage, or where the carriage is to stand without firing for extended periods, the cylinder should be coated with the light slushing oil used for the bores of guns.

The counter-recoil springs should be dismantled at least once every six months and be thoroughly cleaned. All rust should be removed and the springs well oiled before reassembling. When the springs are dismantled the interior of the cradle should be cleaned and examined for defective riveting, missing rivet heads, and scoring. The condition of the spring-support guides should be noted and all burrs or scores carefully smoothed off.

The recoil guide rails of the cradle should be kept well lubricated. Immediately before beginning to fire, they should be oiled through all the oil holes of the gun and dust guard. Lack of proper lubrication of these guide rails is the most frequent cause of failure of gun to return fully into battery.

The contact surfaces between cradle and rocker should be kept clean, thoroughly oiled, and free from rust. If indications of rusting, cutting, or scoring of these surfaces appear, the cradle should be dismantled, the rust removed, and the rough spots smoothed away.

The elevating and traversing mechanisms should be dismantled at least once every six months for thorough cleaning and overhauling. They should be kept well oiled and should work easily. If at any time either mechanism works harder than usual, it should be immediately overhauled and the cause discovered and removed.

In traveling, the cradle should be locked to the trail by means of the elevating and traversing lock, so as to relieve the pointing mechanisms of all travel stresses.

The wheels and wheel fastenings should be dismantled periodically and the fastenings, hub boxes, axle arms, and axle bore cleaned and examined. All roughness due to scoring or cutting should be smoothed off.

The hollow part of the axle acts as a reservoir for the oil to lubricate the wheel bearings. Experience will show how much oil is needed, but enough should be used to insure that the oil will pass through the axle arms to the hub caps.

The nuts on the hub bolts should be tightened monthly during the first year of service and twice a year thereafter. The ends of the bolts should be lightly riveted over to prevent the nut from unscrewing. When the hub bolts are tightened, the hub band should be screwed up as tightly as possible against the lock washer at the outer end of the hub ring.

*The importance of strict compliance with these instructions can not be overestimated.* The wooden parts of the wheels are made of thoroughly seasoned materials, and the hub bolts and bands, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if the wheel is used in this condition it will rapidly be made unserviceable and may be damaged beyond repair.



## THE 3-INCH GUN LIMBER, MODEL OF 1902.

[Plate XIV.]

## WEIGHTS, DIMENSIONS, ETC.

Weight, complete, empty.....	pounds.....	964
Weight of tools and equipment carried.....	do.....	101
Weight of ammunition carried.....	do.....	675
Weight, completely equipped and loaded.....	do.....	1,740
Weight of gun, carriage, and limber, completely equipped and with 40 rounds of ammunition.....	pounds.....	4,260
Rounds of ammunition carried in limber chest.....	number.....	36
Diameter of wheels.....	inches.....	56
Width of track.....	do.....	60
Free height under limber (and carriage).....	do.....	22
Turning angle with carriage.....	degrees.....	80
Turning angle with caisson.....	do.....	75

## NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheels and wheel fastenings.....	Same as on carriage.....		
1	Axle.....	.....		
1	Middle rail (upper and lower half).....	Riveted to axle.....		
	Consisting of—			
1	Pole clamp.....	Riveted to middle rail.....		
1	Pole-prop bracket.....	Riveted to pole clamp and middle rail with limber prop in place.		
1	Pole-clamp bolt.....	In pole clamp.....		
1	Pole-clamp nut.....	.....		
1	Pole pin.....	Secures pole in seat.....		
1	Pole-pin reinforce.....	Riveted to lower half of middle rail.....		
1	Pole stop.....	Riveted between upper and lower half of middle rail.....		
2	Separating pieces.....	Riveted to middle rail with side rails.....		
1	Doubletree strap.....	Riveted to middle rail.....		
1	Doubletree bolt.....	In bolt clamp and doubletree strap.....		
1	Doubletree nut.....	.....		
1	Side rail (right).....	Riveted to axle and middle rail.....		
	Consisting of—			
1	Reinforce plate, front.....	Riveted to side rail.....		
4	Reinforce plates, rear.....	do.....		
4	Sleeves.....	do.....		
1	Step.....	do.....		
1	Pole-prop pocket.....	do.....		
1	Side rail (left).....	Riveted to axle and middle rail.....	VI	3
	Consisting of—			
1	Reinforce plate, front.....	Riveted to side rail.....		
4	Reinforce plates, rear.....	do.....		
4	Sleeves.....	do.....		
1	Step.....	do.....		
1	Pole-prop support.....	do.....		
1	Strap fastener.....	Riveted to side rail, for pole-prop strap.....		
1	Name plate.....	Riveted to middle rail.....		
1	Limber prop.....	Assembled to middle rail by means of pole-clamp eye.		
	Consisting of—			
1	Limber-prop foot.....	Pinned to bottom of prop.....		
1	Limber-prop eye.....	Pinned to top of prop.....		
1	Chain.....	Secured to prop foot.....		
1	Prop tube.....	Hinged to pole by prop eye.....		
1	Prop-chain fastening.....	Riveted to chain.....		
1	Prop-chain eye.....	Riveted to prop tube.....		
1	Tie-rod, rear (right).....	Brace middle rail from axle.....		
1	Tie-rod, rear (left).....	do.....		
2	Tie-rods, front.....	do.....		
1	Tie-rod clamp (right).....	On axle arms.....		
1	Tie-rod clamp (left).....	do.....		
6	Tie-rod pins.....	Fasten ends of tie-rods.....		
2	Doubletree rods.....	From doubletree to axle.....		
2	Doubletree rod pins.....	Secure rods to tie-rod clamps.....		



## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Foot rest, consisting of—			
1	Angle piece (right).....	Riveted to foot rest.....		
1	Angle piece (left).....	do.....		
2	Foot-rest liners.....	do.....		
1	Pick-handle rest, large end.....	do.....		
1	Pick-handle rest, small end.....	do.....		
1	Pick pocket, needle end.....	do.....		
1	Pick head lower strap fastener.....	do.....		
1	Prop-chain button.....	do.....		
1	Prop-chain rivet.....	do.....		
1	Ax-handle bracket.....	do.....		
1	Strap fastener for shovel handle.....	do.....		
1	Pintle with bearing, complete, consisting of—			
1	Pintle.....	Seated in pintle bearing.....		
1	Pintle latch.....	On pintle.....		
1	Pintle latch pin with split pin.....	Forms pivot of latch.....		
1	Pintle latch spring.....	On pintle.....		
1	Pintle bearing (in two parts).....	Rear end of middle rail.....		
1	Pintle spring.....	In pintle bearing.....		
1	Pintle spring pin.....	do.....		
2	Pintle bearing bolts with nuts.....	Secures bearings to middle rail.....		
1	Doubletree.....	On doubletree bolt.....		
	Consisting of—			
1	Doubletree body with reinforce.....			
10	Separators.....			
1	Nipple separator.....	Riveted together.....		
1	Double hook (right).....			
1	Double hook (left).....			
1	Doubletree nipple.....	Renewable.....		
1	Nipple nut.....			
1	Pole, complete, consisting of—			
1	Pole body.....			
1	Pole plug.....	Riveted in body.....		
1	Neck-yoke counter stop spring.....	Bears on neck-yoke counter stop.....		
1	Neck-yoke counter stop pin.....	Riveted in body.....		
1	Neck-yoke counter stop.....	Hinges on counter stop pin.....		
1	Neck-yoke stop.....	Riveted to body.....		
1	Neck-yoke chafing plate.....	Riveted to upper side of body.....		
1	Neck-yoke stop separator.....	Inside of body.....		
1	Neck-yoke stop rivet separator.....	do.....		
1	Pole pin bushing.....	do.....		
1	Butt reinforce.....	Riveted to inside of body.....		
1	Ammunition chest, complete, consisting of—			
2	Door chains.....	Attached to chest door.....		
1	Shot bolt (right).....	On chest door.....		
1	Shot bolt (left).....	do.....		
1	Shot-bolt bracket (right).....	Riveted to door.....		
1	Shot-bolt bracket (left).....	do.....		
2	Shot-bolt stops.....	do.....		
1	Padlock.....	Fastened to chain.....		
1	Padlock chain.....	Fastened to door.....		
1	Lock hinge.....	Riveted to door.....		
1	Lock hasp.....	Hinged to door.....		
1	Hinge pin.....			
1	Lock cam.....	Riveted to top of chest.....		
1	Lock bolt.....	In lock hasp.....		
1	Lock spring.....	On lock bolt.....		
1	Lock handle.....	do.....		
2	Handrail tubes.....	Riveted on handrail brackets so as to make rights and lefts.....		
1	Handrail forward bracket (right).....	Riveted on chest.....		
1	Handrail forward bracket (left).....	do.....		
1	Handrail rear bracket (right).....	do.....		
1	Handrail rear bracket (left).....	do.....		
1	Bucket holder.....	Riveted to top of chest, forms seat.....		
1	Chest rail (right).....	Riveted to bottom of chest.....		
1	Chest rail (left).....	do.....		
8	Washers.....	On chest-rail rivets.....		
4	Chest-rail connections.....	Riveted to chest.....		
4	Connection pins.....	Fit through side rails and chest-rail connections.....		
1	Body, lower plate.....			
1	Body, upper plate.....			
4	Door hinges, male.....	Riveted to door.....		
4	Door hinges, female.....	Riveted to chest bottom.....		
4	Door-hinge pins.....	Fit in door hinges.....		

<sup>1</sup> The components are for the steel pole, which will be issued to replace the wooden pole when the latter becomes unserviceable and the present supply of wooden poles is exhausted.

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Ammunition chest, complete, consisting of—Continued.			
2	Door-chain fasteners.....	Riveted on door.....	IV	3
8	Diaphragm angles.....	Riveted on diaphragms.....		
1	Filler piece (right).....	Under shot-bolt bracket.....		
1	Filler piece (left).....	do.....		
1	Pa llock staple.....	Riveted to door.....		
1	Chest-front reinforce.....	Riveted to chest front.....		
1	Front diaphragm.....	Riveted to chest body.....		
1	Middle diaphragm.....	do.....		
1	Rear diaphragm.....	do.....		
2	Diaphragm braces.....	Connects front and middle diaphragms.....		
1	Stiffener.....	Riveted to chest body.....		
1	Chest front.....	do.....		
1	Door.....	Hinged to chest body.....		
1	Door frame.....	Riveted to door.....		
39	Ammunition-chest connecting pieces.....	Connects rear and middle diaphragms.....		
78	Reinforce pieces.....	Brazed on ammunition-chest connecting pieces.....		
1	Hatchet-blade bracket.....	Riveted to chest.....		
1	Hatchet-handle fastener.....	do.....		
1	Pick pocket, chisel end.....	do.....		
1	Ax-head bracket.....	do.....		
1	Shovel-blade bracket.....	do.....		
1	Lantern bracket, consisting of—			
1	Lantern-bracket body.....	do.....		
1	Lantern-bracket bottom.....	Riveted to body.....		
2	Lantern-strap fasteners.....	do.....		
3	Grip-strap fasteners.....	Riveted to chest.....		
3	Strap fasteners for paulin strap.....	Riveted to bucket holder.....		
14	Rope-strap fasteners.....	Riveted to chest; 8 are for blanket straps.....		
2	Rope-strap fasteners (special).....	Riveted to chest.....		
1	Strap fastener for ax strap.....			
1	Shovel-handle bracket.....	Riveted to foot rest and middle rail.....		

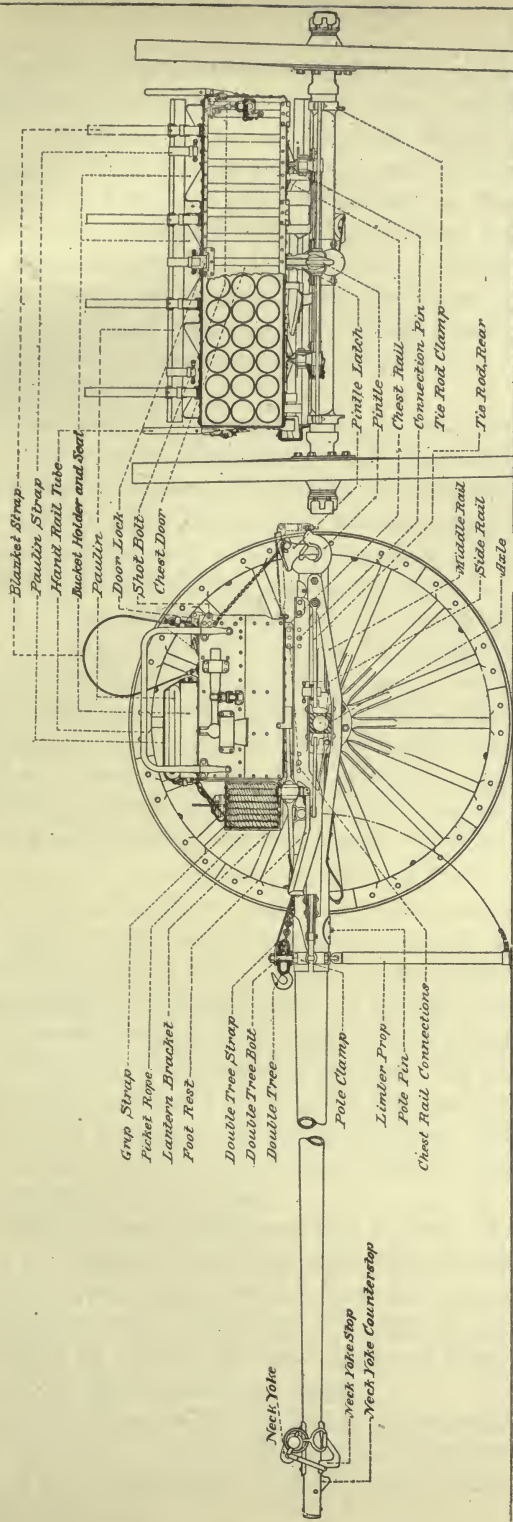
## DESCRIPTION OF THE 3-INCH GUN LIMBER, MODEL OF 1902.

[Plate XIV.]

The limber is of metal throughout, excepting the spokes and fellos of the wheels. The principal parts are the wheels, axle, frame, ammunition chest, pole, doubletree, singletrees, and neck yoke.

The wheels and wheel fastenings are the same as, and interchangeable with, those used on the carriage. The axle is hollow and is made of a single piece of forged steel. The axle arms and the grooves for the wheel fastenings are finished to the same shape and size as those of the carriage axle. The axle body is provided with lugs, to which the middle and side rails of the frame are riveted.

The frame consists of a middle and two side rails riveted to the axle lugs and braced as shown on the drawings. The middle rail is in the form of a split cylinder, one half passing below and the other half above the axle. The two halves are united in front to form a pole seat and in rear to form a seat for the pintle bearing. Two lugs are provided on the axle near each axle arm. Tie-rods, two in front and two in rear, are pinned to these lugs and attached to the front and rear ends of the middle rail. The tie-rods are assembled under tension and rigidly brace the pole and pintle seat. To the front end of the middle rail is riveted the pole clamp—a steel collar,



*Limber, Side and Rear Views*

Scale:  $\frac{1}{4}$  inch = 1 foot





split on one side and provided with a clamping bolt for drawing the two halves of the middle rail firmly about the pole. A seat for the doubletree is formed on top of the pole clamp; the doubletree bolt projects up through this seat and through the doubletree; its upper end is threaded for a nut and braced back to the middle rail by the doubletree strap. Riveted to the lower side of the clamp is the prop bracket, which is connected to the prop by the prop eye. When not in use this prop is swung up under the frame by a chain attached to its lower end and reaching up through the foot rest and is held in that position by hooking the free end of the chain over a button provided for the purpose.

The pintle bearing is of bronze, made in halves and bored out to take the pintle shank. The two halves of the bearing, with the pintle in its seat, are assembled and held in the rear end of the middle rail by two pintle-bearing bolts. The pintle has a swiveling motion of  $360^{\circ}$  upon its shank, but is kept in its normal position by the pintle spring in the pintle bearing, which bears upon a flattened seat on the front end of the shank. The lunette is retained upon the pintle hook by a pintle latch. The latter is pivoted by the pintle-latch pin upon the end of the pintle horn and is arranged to be held in either the open or closed position by the pintle-latch spring. The latch is opened by the lunette in entering it upon the pintle hook, but must be closed by hand. The spring is peened in its seat, but may readily be driven out and a new one inserted, if required.

The side rails are of channel shape, divided at the front, one branch being led forward and secured to the middle rail near the pole seat, while the other branch is utilized as a foot-rest support. The foot rest is a perforated steel plate formed to shape and riveted to the middle and side rails in front of the ammunition chest. The latter is secured to and supported by the side rails. For this purpose four connection lugs are riveted to and project downward from two chest rails on the bottom of the chest. The connections fit into four slots made in the top of the side rails and are held in place by connection pins passing through both pieces. The rear ends of the side rails project slightly beyond the chest to form steps for the use of the cannoneers in mounting.

The doubletree and singletrees are formed of flange steel. The hole in the former for the doubletree bolt is bushed with a bronze nipple held in place by a steel nut, and may be replaced when worn. Two doubletree rods reach from the ends of the doubletree to the tie-rod clamps on the axle to which they are pinned. The neck yoke is now made of steel sleeves and rings.

The pole is now made of steel and is prevented from turning in its seat by a pole pin. To the front end of the pole is riveted a pole plug and a neck-yoke stop. Just forward of the neck-yoke stop is

the neck-yoke counterstop, which, with its spring, is hinged to the pole body and works through a slot cut in the under side of the pole. A pole prop is hinged to the rear end of the pole and when not in use it is secured by fastenings under the limber frame and the prop-chain button on the foot rest.

The ammunition chest is a rectangular steel box built up of sheet steel, formed to shape and riveted together. The front of the chest is flanged all around and riveted through the flanges to the body of the chest. The chest door is hinged at the bottom and swings downward and to the rear to an approximately horizontal position, where it is held by two door chains. The front of the chest and the door are strengthened by vertical corrugations pressed into the metal, those in the chest door serving as shields for the primers of the cartridges. The door is held in its closed position by a shot bolt at each of the upper corners and by a chest door lock in the middle. Each shot bolt slides in a shot-bolt bracket formed of sheet steel and riveted to the door; the end of the bolt engages in an eye lug projecting from the body of the chest. The shot bolt on the right is provided with an eye, by which it may be locked by a spring padlock to a staple riveted to the door. The padlock is attached by a chain to the lock staple. The chest door lock at the middle of the door comprises a hasp hinged to the door and engaging over a cam lug riveted to the top of the chest. A spring-lock bolt in the hasp automatically secures the hasp to the cam when the former is thrown into position.

Inside of the chest the cartridges are supported by three vertical diaphragms, flanged all around and riveted to the body of the chest. Each of the diaphragms is perforated with 39 flanged holes.

Corresponding holes in the middle and rear diaphragms are connected by conical brass tubes, called connecting pieces, which are cut away on top to reduce weight. These connecting pieces support the front end of the cartridge case and enable empty cases to be carried. The rear end of the connecting piece is turned over the rear face of the flange of the perforation in the rear diaphragm, and forms a stop for the rim of the cartridge case. The chest door closes against the head of the case so that the cartridge is firmly held in position. Suitable finger clearances are cut in the flange of each cartridge hole in the rear diaphragm to enable the fingers to get a good hold on the rim of the case in withdrawing it from the chest.

To the under side and front of the chest are riveted two rails to which the connections for securing the chest to the frame are fastened. Seats for three cannoneers are provided by a perforated metal bucket holder, riveted to and slightly raised above the chest top. The paulin issued with each limber serves as a seat cushion, and is held in place by three paulin straps suitably fastened. The watering buckets are carried in suitable compartments provided for them



between the seat and the chest. At each end of the seat is a handrail which projects above the top of the chest and is securely riveted to its ends. To the front of the chest are riveted a bracket for a lantern and fasteners for four picket-rope straps for securing two picket ropes. (One picket rope is issued for light batteries; two picket ropes are issued for horse batteries.) Fasteners are also provided on the front of the chest for three grip straps for the use of the cannoneers on the chest seat. Brackets for carrying an ax, a shovel, and pole prop are provided under the limber. The shovel is carried on the right, the ax on the left side of the middle rail, with handles to the front. The blade brackets for these implements are riveted to the bottom of the chest, the handle brackets to foot rest and limber frame. The pole-prop brackets are attached to the side rails just in rear of the axle. The pickax rests in brackets on the foot rest with handle pointing to the right and lying along the rear edge of the foot rest under the lantern bracket and picket rope. The hatchet is carried in two brackets riveted to the left end of the chest. All of these implements are secured in their brackets by leather straps, which are held by strap fasteners provided for that purpose. With each limber are issued three oil cans, each of the general form of a cartridge and of a capacity of approximately two-thirds of a gallon. They are intended for hydroline, lubricating, and coal oil, and are to be carried inside the chest in the central vertical row of cartridge holes.

A name plate is attached to the middle rail of each limber near the pintle seat, giving number, name of carriage, model, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence the limber should be designated by the number, name, etc., as given thereon.* As repairs to implement attachments and other parts of limbers may from time to time be required, the parts needed should be referred to by the names given on the drawings or in the nomenclature of parts herein.

### THE 3-INCH GUN CAISSON, MODEL OF 1902.

[Plates XV and XVI.]

#### WEIGHTS, DIMENSIONS, ETC.

Weight, empty, without implements and ammunition.....	pounds..	1,424
Weight of tools and equipment carried.....	do.....	84
Weight of ammunition carried.....	do.....	1,312.5
Weight, complete, equipped and loaded.....	do.....	2,820
Weight with limber, completely equipped and with 106 rounds of ammunition.....	pounds..	4,560
Rounds of ammunition carried.....	number..	70
Diameter of wheels.....	inches..	56
Width of track.....	do.....	60
Free height under caisson.....	do.....	22.5
Turning angle.....	degrees..	75

## NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheels.....	Same as on carriage.....		
2	Wheel fastenings, complete.....	do.....		
1	Axle.....	.....		
1	Middle-rail angle (right).....	Riveted to axle and side rail.....		
1	Middle-rail angle (left).....	do.....		
1	Middle-rail plate.....	Riveted to middle-rail angles.....		
1	Side rail (right).....	Riveted to axle lugs.....		
1	Side rail (left).....	do.....		
4	Filler plates.....	Riveted to side-rail flanges.....		
1	Pintle with bearing, complete, consisting of—			
1	Pintle.....	Seated in pintle bearing.....		
1	Pintle latch.....	On pintle.....		
1	Pintle-latch pin, with split pin.....	Forms pivot of latch.....		
1	Pintle-latch spring.....	On pintle.....		
1	Pintle bearing (in two parts).....	Rear end of middle rail.....		
1	Pintle spring.....	In pintle bearing.....		
1	Pintle-spring pin.....	do.....		
2	Pintle-bearing bolts with nuts.....	Secures bearing to middle rail.....		
1	Name plate.....	Riveted near rear end of side rails.....		
1	Fuze-setter bracket rod lug.....	Riveted to right side rail.....		
1	Brake channel.....	Fastened to side rails.....		
4	Channel supports.....	Fasten channel to side rails.....		
1	Cross brace.....	Riveted to side rails.....		
1	Frame handle (right).....	Front end of side rails.....		
1	Frame handle (left).....	do.....		
1	Frame reinforce plate.....	do.....		
1	Lunette bracket.....	do.....		
1	Lunette bracket filler plate.....	Under lunette bracket.....		
1	Lunette, with nut.....	Secured in lunette bracket.....		
1	Caisson prop, complete.....	On front end of side rails.....		
	Consisting of—			
1	Prop eye (right).....	Riveted to right tube.....		
1	Prop eye (left).....	Riveted to left tube.....		
2	Prop tubes.....	Supports pole.....		
1	Prop foot.....	Riveted to lower ends of tubes.....		
1	Fastening pin.....	Through prop eyes.....		
1	Fastening-pin washer nut.....	On fastening pin.....		
1	Fastening nut.....	Secures prop to vehicle.....		
2	Prop-chain clamps.....	On prop tubes.....		
2	Prop chains.....	Secured to prop.....		
1	Prop hook.....	On chain.....		
1	Prop-chain button.....	Riveted into lunette bracket.....		
2	Prop-chain guides.....	Riveted to cross brace.....		
1	Box bottom (right).....	Riveted to ends of brake channel.....		
1	Box bottom (left).....	do.....		
2	Brake-box fillers.....	do.....		
1	Brake-beam guide (right).....	Riveted to brake channel.....		
1	Brake-beam guide (left).....	do.....		
1	Front-brake brace (right).....	Brake channel to side rails.....		
1	Front-brake brace (left).....	do.....		
1	Rear-brake brace (right).....	do.....		
1	Rear-brake brace (left).....	do.....		
2	Brake beams.....	Seated in brake boxes.....		
2	Brake shoes.....	On end of brake beams.....		
4	Brake-shoe tap bolts (short).....	Secure shoes to beams.....		
2	Brake-beam pins.....	Form pivots.....		
2	Brake-rod ends.....	Connects rods to brake beams.....		
2	Brake rods.....	Connect beams to cranks.....		
	Including—			
2	Brake-rod springs.....	On brake rods.....		
2	Brake-spring covers.....	do.....		
2	Brake-spring-cover heads.....	do.....		
2	Brake-spring-cover ends.....	do.....		
4	Brake-rod pins.....	Secure rods to beams and cranks.....		
2	Brake cranks.....	On brake shaft.....		
2	Brake-crank bolts, with nuts.....	Clamp cranks on shaft.....		
1	Brake shaft, with two keys.....	In shaft bearings on axle.....		
3	Brake-shaft bearings.....	Riveted to axle lugs.....		
3	Brake-shaft bushings.....			
1	Brake-segment bracket.....	Clamped on right end of axle.....		
1	Brake-segment bushing.....	On brake-segment bracket.....		
1	Brake-segment bracket bolt, and nut.....	Clamps bracket to axle.....		
1	Brake segment.....	Riveted to bracket.....		
1	Brake-segment brace.....	Riveted to brake segment.....		
1	Brake-segment guard.....	Riveted to segment.....		
1	Segment rack.....	do.....		
1	Front separator.....	Between segment and guard.....		
1	Rear separator.....	do.....		

IV

3



## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Rear-separator bolt.....	Through rear separator.....	IV	
1	Brake lever.....	On end of shaft.....		
1	Brake-lever catch.....	Riveted on brake lever.....		
1	Spare-pole fastening.....	On caisson prop pin.....		
1	Fastening nut.....	On spare-pole fastening.....		
2	Fastening washers.....	On spare pole.....		
1	Spare-pole bracket.....	Riveted to middle rail.....		
1	Spare-pole rest.....	Riveted to brake channel.....		
1	Pick-mattock bracket.....	do.....		
1	Shovel-handle support.....	Riveted to cross brace.....		
2	Strap fasteners for pick mattock.....	Riveted to pick-mattock bracket and brake channel.....		
1	Ammunition chest, complete, consisting of—			
1	Top plate.....	Riveted to bottom plate.....		
1	Bottom plate.....	Riveted to chest rails.....		
1	Rear diaphragm.....	Riveted to chest.....		
1	Middle diaphragm.....	do.....		
1	Front diaphragm.....	do.....		
2	Front-diaphragm braces (1 right, 1 left)	Riveted to front plate, front diaphragm, and bottom plate.....		
2	Middle-diaphragm braces (1 right, 1 left).	Riveted to front and middle diaphragms, and bottom plate.....		
2	Rear-diaphragm braces (1 right, 1 left)	Riveted to middle and rear diaphragms, and bottom plate.....		
9	Diaphragm tees, long.....	Riveted to diaphragm.....		
2	Diaphragm tees, short.....	Riveted to rear diaphragms.....		
70	Connecting pieces.....	Rolled into rear and middle diaphragms.....		
140	Reinforce pieces.....	Soldered on connecting pieces.....		
1	Front plate.....	Riveted to angle.....		
1	1 by 1 by 0.125 chest angle.....	Riveted to body.....		
3	Chest-front braces.....	Riveted to front plate.....		
1	Ax-head bracket.....	do.....		
1	Ax-handle support.....	do.....		
1	Ax-strap fastener.....	do.....		
3	Grip-strap fasteners.....	Riveted to chest.....		
3	Paulin-strap fasteners.....	do.....		
1	Shovel support.....	Riveted to bottom of chest.....		
4	Reinforce washers.....	Under rivet heads for pick-mattock handle support and shovel support.....		
1	Pick-mattock handle support.....			
1	Wrench holder for spanner wrench.....	Riveted to left side of chest.....		
1	Wrench holder for spanner wrench.....	do.....		
1	Wrench holder for nut wrench.....	do.....		
1	Wrench holder for nut wrench.....	do.....		
2	Strap fasteners for wrenches.....	Riveted to chest.....		
1	Chest rail (right).....	Riveted to bottom plate.....		
1	Chest rail (left).....	do.....		
2	Filler pieces.....	Riveted to chest body and chest rails.....		
1	Apron latch hinge (right).....	Riveted to chest rails.....		
1	Apron latch hinge (left).....	do.....		
1	Foot rest.....	do.....		
4	Handrail shanks.....	Riveted to sides of chest.....		
2	Handrails.....	Riveted to handrail shanks.....		
1	Door prop guide (right).....	Riveted to sides of chest.....		
1	Door prop guide (left).....	do.....		
1	Door plate.....	Hinged to chest.....		
3	Door tees.....	Riveted to inside of door.....		
4	Door tees.....	do.....		
1	Angle.....	do.....		
1	Lock bar (right).....	Lock-bar hinges riveted to chest.....		
1	Lock bar (left).....	do.....		
2	Padlock chain rivets.....	On lock bars.....		
2	Wing nuts.....	Fastened to door plate.....		
2	Wing nut pins.....	Riveted to door plate.....		
2	Wing nut pin washers.....	On pins.....		
1	Padlock with chain and bolt snap.....	Attached to lock bar.....		
1	Chain with two chain rings and bolt snap.....	do.....		
1	Padlock chain staple.....	Riveted to bottom plate.....		
2	Door prop studs.....	Riveted to door plate.....		
2	Nuts.....	For studs.....		
2	Door props.....	Pivoted on studs.....		
2	Door prop rivets.....			
4	Door hinge pins.....	Fasten door plate to chest.....		
1	Door handle.....	Riveted to door plate.....		
1	Fuze setter latch hinge.....	do.....		
4	Lock bar hinges.....	Riveted to bottom plate.....		



## NOMENCLATURE OF PARTS—Continued.

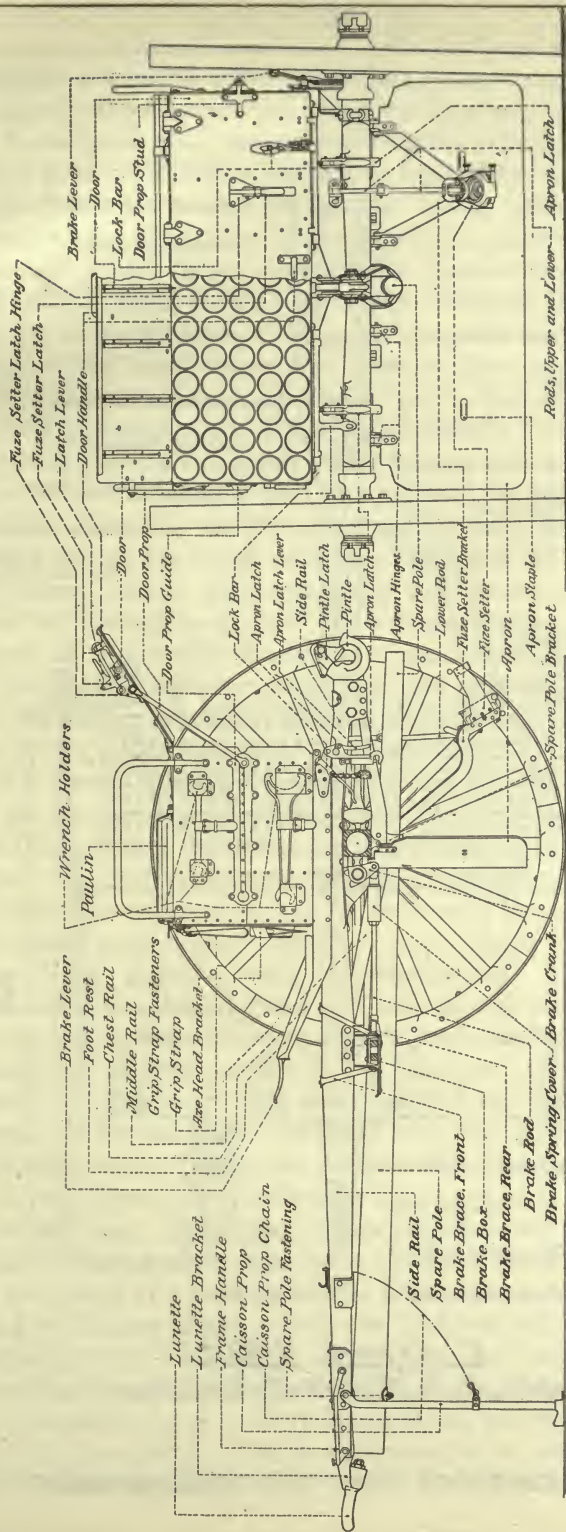
No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Ammunition chest, complete, consisting of—Continued.			
4	Door hinges, male.....	Riveted to door plate.....		
4	Door hinges, female.....	Riveted to top plate.....		
1	Apron, complete, consisting of—			
1	Apron.....	Hinged under axle.....		
2	End hinge filler pieces.....	Riveted to apron.....		
1	Center hinge (right).....	do.....		
1	Center hinge (left).....	do.....		
1	End hinge (right).....	do.....		
1	End hinge (left).....	do.....		
1	Apron staple (right).....	do.....		
1	Apron staple (left).....	do.....		
2	Hinge pins.....	Secure apron to axle.....		
2	Hinge pins.....	Secure apron and fuze-setter bracket to axle.....		
2	Apron latches, complete.....	Pivoted on hinges on chest rails.....		
	Consisting of—			
2	Hinge pins.....	Attach latch body to hinge.....		
2	Latch bodies.....			
2	Latch levers.....	Pivoted on bodies.....		
2	Lever pins.....	Form pivots for levers.....		
2	Latch plungers.....	Seated in body.....		
2	Latch clevises.....	Screwed on end of plunger.....		
2	Latch clevis pins.....	Attach clevis to lever.....		
2	Latch springs.....	In body around plunger.....		
2	Latch bushings.....	Screwed into body.....		
1	Fuze-setter bracket.....	Attached to axle brackets by apron-hinge pins.....	IV	3
	Consisting of—			
1	Upper rod.....	Pinned to bracket-rod lug and to lower rod.....		
1	Lower rod.....	Pinned to upper rod and to fuze-setter bracket.....		
1	Fuze-setter bracket end (left).....	Hinged to axle bracket.....		
1	Fuze-setter bracket end (right).....	do.....		
1	Fuze-setter bracket arm (right).....	Riveted to fuze-setter bracket end (right).....		
1	Fuze-setter bracket arm (left).....	Riveted to fuze-setter bracket end (left).....		
3	Pins.....	For upper and lower rod.....		
1	Separator.....	Riveted to fuze-setter bracket arms.....		
1	Staple.....	do.....		
1	Fuze-setter latch, complete.....	Pinned to hinge on chest door plate.....		
	Consisting of—			
1	Latch body.....	do.....		
1	Hinge pin.....	Attaches body to door plate.....		
1	Latch lever.....	Pivoted on body.....		
1	Lever pin.....	Attaches lever to body.....		
1	Latch plunger.....	Seated in body.....		
1	Latch clevis.....	Screwed on end of plunger.....		
1	Latch clevis pin.....	Attaches clevis to lever.....		
1	Latch spring.....	In body around plunger.....		
1	Latch bushing.....	Screwed into body.....		
	NOTE.—Parts of apron latches and fuze-setter latches are not interchangeable, and requisitions for spare parts should state specifically for which latch required.			

## DESCRIPTION OF THE CAISSON.

[Plates XV and XVI.]

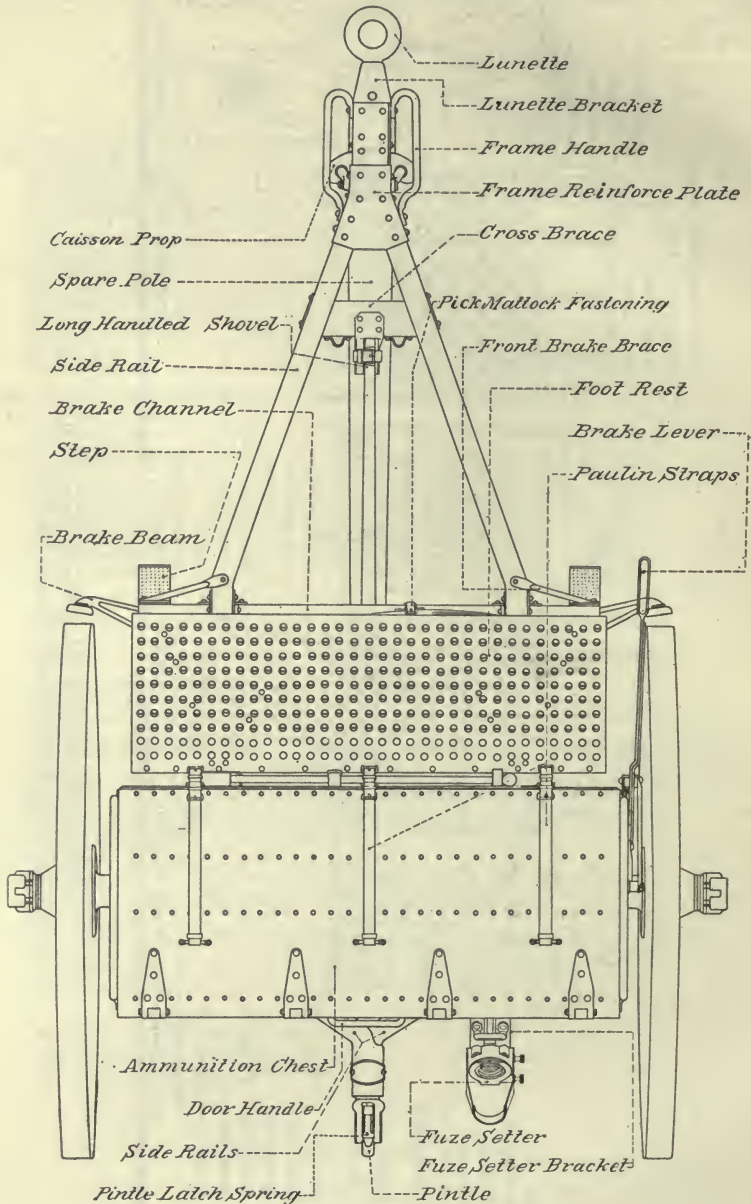
The caisson is made of metal throughout, with the exception of parts of the wheels. The principal parts are the wheels, axle, frame, road brakes, and ammunition chest.

The wheels and wheel fastenings are interchangeable with those of the carriage and limber. The axle is similar in design, but larger in

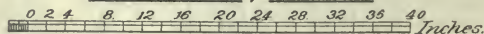


*Caisson Side and Rear Views*

Scale: 0.1 5 10 15 20 25 30 35 Inches



Caisson, Plan





section than the limber axle, and differs from it also in the location of the lugs for the attachment of the frame and apron hinges.

The frame is diamond shaped and consists principally of two steel side rails of channel section riveted to lugs on the axle and meeting in front of it at the lunette and in rear at the pintle. Opposite the front part of the wheels the two side rails are connected by a 4-inch steel channel, which forms a support for the road-brake beams. The middle rail is formed of two steel angles riveted to lugs on the lower side of the axle. In rear of the axle the middle rail braces the two side rails at the point where they meet to form the pintle seat; in front the two parts of the middle rail extend diagonally forward and are secured to the side rails at the brake channel.

The pintle bearing and pintle of the caisson are in all respects similar to and interchangeable with like parts of the limber. The front ends of the side rails are brought together and securely riveted to each other and to the frame reinforce plate and the lunette bracket. To the latter a lunette, interchangeable with the one on the carriage, is assembled by the lunette nut. Two frame handles are attached to the frame at the lunette bracket. A stout cross brace of channel shape is riveted to and strengthens the side rails at the point of contact of the limber wheels in making short turns. A caisson prop, formed of two steel tubes united by a bronze foot, is hinged on a prop pin which passes through the side rails and lunette bracket. When not in use the prop is swung up under the spare-pole body and is held in that position by chains leading from the prop legs through guides on the cross brace and uniting in a hook which is engaged over a button riveted into the top of the lunette bracket.

The caisson road brake is modeled after that of the carriage, all parts as far as possible being interchangeable. The ends of the brake channel are braced front and rear to the side rails, and on their lower side is formed a box in which the brake beams are pivoted. The brake-box bottoms project to the front and form steps for the cannoneers in mounting. The outer ends of the beams carry brake shoes attached by tap bolts; the inner ends are supported by brake-beam guides riveted to the brake channel. The front end of the brake rod is screwed into a piece, called the brake-rod end, which is pinned to the brake beam. The brake-rod spring slips over the rear end of the brake rod and abuts against a shoulder upon it. The brake spring is covered by a tube called the brake-spring cover, inclosed at each end by bronze pieces, called the brake-spring-cover head and brake-spring-cover end. The spring is compressed between the brake-spring-cover end and the shoulder on the brake rod, while the rod is arranged to have a short longitudinal movement against the pressure of the spring. The brake-spring-cover end is pinned to cranks on the brake shaft. This elastic brake rod is in all respects

similar to that upon the carriage, and all parts (excepting the rod proper) are interchangeable with like parts of the carriage brake.

The cranks are secured on the brake shaft by clamp bolts and are keyed to prevent turning. The shaft is assembled in three bearings riveted to the axle lugs. The brake lever is mounted on the right end of the shaft, is held in place by the brake guard, and extends upward and forward in a convenient position for use by a cannoneer seated on the chest. A brake segment bracket is clamped and keyed to the axle and has riveted to it a tool steel segmental rack provided with ratchet teeth. The brake is set by engaging the brake-lever catch in the rack on this segment.

The caisson ammunition chest is a rectangular steel box built up of flange steel, formed to shape and riveted together in a manner similar to the limber chest, but is larger, making provision for 70 rounds of ammunition arranged in five horizontal rows of 14 rounds each. Caissons having serial numbers 1141 to 1284 inclusive have provision for 56 rounds of ammunition only, arranged in four horizontal rows of 14 rounds each. The front of the chest is made of armor plate, 0.15 inch thick. A steel angle is riveted to the armor plate all around its edge, and the projecting leg of the angle riveted to the body of the chest. Three steel tees, placed vertically and riveted to the inside of the front plate, gives stiffness to the latter.

Inside the chest the cartridges are supported by three vertical diaphragms flanged all around and riveted to the body of the chest. Each diaphragm is perforated with 70 flanged cartridge holes. Corresponding holes in the middle and rear diaphragms are connected by conical brass connecting pieces, which are in all respects similar to those used in the limber chest. The diaphragms are rigidly braced to each other and to the chest front and bottom by six diaphragm braces riveted in place over the side rails.

To the front and middle diaphragms are riveted vertically three long steel tees. To the rear diaphragm three long and two short steel tees are riveted. For caissons not equipped with diaphragm braces, the rear diaphragm has five steel tees. For caissons carrying only 56 rounds of ammunition three long steel tees are riveted to each diaphragm.

The chest door is made of armor plate, 0.15 inch thick. It is hinged to the body of the chest at the top by four hinges and is held closed by two lock bars hinged to the bottom of the chest. A hasp and two eccentric lugs are formed upon each of these bars; in locking the door the lugs come into contact with its lower edge, pressing it forward, while the hasp engages a wing nut on its rear face. The left lock-bar hasp has a spring padlock attached by a chain; the left bar hasp is fitted with a bolt snap which when snapped in the wing-nut eye serves to lock the hasp in position.



Seven steel tees are riveted to the inner face of the door. These tees are spaced so that with the door closed the vertical leg of the T falls between each alternate row of cartridges and the horizontal legs press against the heads of the cartridges. The rims of the cartridge cases are thus firmly held between the rear diaphragm and the door tees, which, in addition to forming stiffeners for the door, provide clearances between the door plate and the cartridge percussion cap for the protection of the latter. The lower edge of the door is also stiffened by a steel angle, running its entire length.

The door opens upward to the rear, swinging through an arc of  $120^\circ$  to its open position, where it is held at each end by a door prop. One end of each prop runs in a door-prop guide riveted to the end of the chest; the other end of the prop is secured by a nut on a door-prop stud riveted to the door. As the door is thrown open the props catch in notches in the guides and hold it in the open position; to close the door the props must be released by hand from the guide notches.

The top of the chest forms a seat for cannoneers and has a hand-rail at each end. To strap fasteners riveted to the front and top of the chest are attached three grip straps for the use of the cannoneers and three paulin straps for securing the paulin, which serves as a seat cushion. To the bottom of the chest are riveted two chest rails of channel section, which fit over and are riveted to the caisson side rails. On all caissons manufactured after November 11, 1911, and on all completely overhauled after that date, steel filler pieces and a filler plate are riveted to each side rail. On these pieces the chest rail rests, thus taking the shear strain off of the rivets in the side flanges of the chest rail and side rail. The chest rails extend to the front and are divided and bent up to support the foot rest, a perforated sheet-metal plate formed to shape and riveted on. To the rear ends of the chest rails are riveted hinges for the apron latches, which support the apron in traveling position.

An apron shield, made of armor plate 0.2 inch thick (0.15 inch in later type), is hinged under the axle and arranged so as to be lowered into position in action or drawn up to clear obstructions in traveling. This apron-shield plate when lowered reaches from the axle to within 5.5 inches of the ground and, in connection with the armored front and door of the chest, affords protection from small-arm and shrapnel fire to the ammunition servers in rear of the caisson. The caisson-apron plate, the chest door plate, and the chest front plate are made of the same quality of material as the carriage shields. For the attachment of the apron to the caisson axle four sets of hinge lugs are formed on the axle, and the apron is attached by hinges to these lugs. It is slightly convex to the front, so that when swung up for traveling it clears the spare pole carried



under the caisson frame. For traveling, the apron is drawn up to the rear, as stated, and is held by two apron latches.

Each apron latch consists principally of a latch body, lever, plunger, and spring. The apron-latch body is supported by a hinge pin passing through the apron-latch hinge riveted to the rear end of the chest rail; the lower end of the latch body terminates in a hook, which engages the latch staple riveted to the apron shield and holds the latter in traveling position. To prevent accidental disengagement of hook from staple, the opening of the hook is closed by a plunger seated in the latch body and pressed outward into action by a coiled spring. An apron-latch lever is provided for withdrawing the plunger from the hook when it is desired to disengage the hook from the staple.

The fuze-setter bracket consists of two angle irons, pivoted at the front upon the two apron-hinge pins on the right side of the caisson and united at the rear to form a seat, to which the fuze setter is securely bolted. A staple is riveted to the bracket near its lower end, and a fuze-setter latch pivoted upon a hinge or support on the chest door is arranged to engage this staple and hold the bracket with fuze setter in traveling position. For use, the fuze setter with bracket is swung down and supported by a jointed rod extending from the lower end of the bracket to the right side rail. This jointed rod or brace consists of upper and lower rods pinned together; the upper rod is also pinned to the bracket-rod lug on the side rail and the lower rod to the bracket itself. This flexible connection enables the rod to fold up when the bracket is swung up for traveling.

The fuze-setter latch is of the same general design as the caisson-apron latch described above, but the parts of the two latches are not interchangeable. The fuze-setter latch body is attached by a hinge pin to a hinge riveted to the rear face of the chest door.

For batteries equipped with wooden poles, a spare-pole body is carried under the caisson frame on each of four caissons. The small end of the pole rests in a leather-covered bracket called the spare-pole bracket, which is riveted to the middle rail directly under the axle; the large end is held in place by the spare-pole fastening, a swinging bolt, the upper end of which is located in the lunette bracket and held in place by the fastening pin; near the center of the pole a third point of support, the spare-pole rest, which is riveted to the brake channel, holds the pole rigidly in place. A long-handled shovel is carried, with the blade resting in the shovel support, riveted to the bottom of the chest, and with the handle supported by the shovel-handle support, attached to the frame cross brace. The pick-mattock head is held by a bracket riveted on the brake channel. The handle projects to the rear through a pick-mattock handle bracket riveted to the bottom of the chest. The ax is carried in

brackets riveted to the front and the two wrenches in brackets riveted to the left end of the chest. All of these implements are secured in their brackets by leather straps, engaging in strap fasteners riveted to various parts of the caisson.

A name plate is attached to each caisson near the pintle, giving the number, name of carriage, model, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence the caisson should be designated by the number, name, model, etc., given on this name plate.* In requests for spare parts for repairs, etc., the parts should be asked for by the names given on the plates or in the paragraph giving nomenclature of parts in this handbook.

### THE 3-INCH GUN CAISSON LIMBER, MODEL OF 1916.

[Plates XVII and XVIII.]

#### WEIGHTS, DIMENSIONS, ETC.

Weight complete, empty	-----pounds--	987
Weight of tools and equipment carried (oil cans filled)	-----do----	113
Weight of ammunition carried	-----do----	675
Weight, completely equipped and loaded	-----do----	1, 775
Weight of gun, carriage, model of 1902, and limber, model of 1916, completely equipped and with 40 rounds of ammunition	-----pounds--	4, 295
Rounds of ammunition carried in limber chest	-----number--	36
Diameter of wheels	-----inches--	56
Width of track	-----do----	60
Free height under limber (carriage, model of 1902=22)	-----do----	24
Turning angle with carriage, model of 1902	-----degrees--	80
Turning angle with caisson	-----do----	81

NOTE.—The 3-inch gun carriage, model of 1916, will not be used with the 3-inch gun limber, model of 1902, or the 3-inch caisson limber, model of 1916, on account of the excessive weight of the 1916 gun carriage. A special carriage limber will be provided for the 1916 carriage.

#### NOMENCLATURE OF PARTS.

[Parts not enumerated in the following list are the same as those for the 3-inch gun limber, model of 1902.]

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Middlerail (upper and lower half).....	Riveted to chest bottom.....	IV	3
	Consisting of—			
1	Doubletree bolt.....	In top of pole clamp.....		
1	Doubletree nut.....	On doubletree bolt.....		
1	Doubletree strap.....	Riveted to middle rail.....		
1	Pole clamp.....	do.....		
1	Pole clamp bolt.....	In pole clamp.....		
1	Pole clamp nut.....	On pole clamp bolt.....		
1	Pole pin.....	Secures pole in seat.....		
1	Pole pin reinforce plate.....	Riveted to middle rail at pin.....		
1	Pole stop.....	Riveted in middle rail.....		
1	Prop bracket.....	Riveted to pole clamp.....		
1	Axle bracket, right.....	Clamped to axle, right end.....		
1	Axle bracket, left.....	Clamped to axle, left end.....		
1	Side rail, right.....	Riveted to axle bracket, right.....		
1	Side rail, left.....	Riveted to axle bracket, left.....		



## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Name plate.....	Riveted to middle rail near pintle.....	IV	3
1	Limber prop.....	Assembled to middle rail by means of prop bracket.....		
	Consisting of—			
1	Prop chain.....	Fastened to prop tube.....		
1	Prop chain fastening.....	Riveted to prop tube.....		
1	Prop chain handle.....	On free end of chain.....		
1	Prop eye.....	In top end of prop tube.....		
1	Prop foot.....	In lower end of tube.....		
1	Prop tube.....	Hinged to pole clamp by prop eye.....		
1	Front tie rod, right.....	Ties middle rail and axle bracket.....		
1	Front tie rod, left.....	do.....		
1	Rear tie rod, right.....	do.....		
1	Rear tie rod, left.....	do.....		
6	Tie rod pins.....	Fasten ends of tie rods.....		
2	Doubletree rods.....	From doubletree to axle brackets.....		
2	Chains, doubletree rod.....	On doubletree rods.....		
1	Foot rest.....	Riveted to side rails.....		
	Consisting of—			
2	Foot-rest plates.....	Riveted to front of foot rest.....		
1	Hole reinforce.....	Riveted to foot rest at prop chain.....		
1	Pick handle fastener.....	Riveted on foot rest.....		
1	Pick-mattock point guard.....	Riveted to foot rest.....		
1	Pole prop pocket.....	do.....		
1	Pole prop support.....	do.....		
1	Prop chain button.....	do.....		
1	Prop chain button rivet.....	do.....		
1	Shovel handle support.....	Riveted under foot rest.....		
1	Strap fastener No. 1.....	For pick-ax strap.....		
1	Strap fastener No. 2.....	do.....		
1	Pintle with bearing, complete.....	At rear end of middle rail.....		
	Consisting of:			
1	Guide bolt.....	In middle rail behind axle.....		
2	Lock plates.....	Lock trunnion and pintle bearing bolts.....		
1	Pintle.....	Seated in pintle bearing.....		
1	Pintle bearing.....	Pivoted in guide.....		
2	Pintle bearing bolts.....	Bolt guide to middle rail.....		
1	Pintle bearing guide.....	In rear end of middle rail.....		
1	Pintle bearing spring.....	In pintle bearing.....		
1	Pintle latch.....	On pintle.....		
1	Pintle latch pin.....	Pins latch to pintle.....		
1	Pintle latch spring.....	On pintle.....		
1	Pintle nut.....	On pintle shank.....		
1	Pole supporting spring.....	Around spring rod.....		
1	Sleeve.....	On pintle shank.....		
1	Spring rod.....	In middle rail behind axle.....		
1	Spring rod nut.....	On spring rod.....		
1	Spring rod pin.....	Pivots spring rod to pintle bearing.....		
2	Trunnion bolts.....	In pintle bearing guide.....		
1	Pole complete, consisting of:			
1	Butt reinforce.....	On rear end of pole.....		
1	Neck yoke chafing plate.....	On pole at neck yoke.....		
1	Neck yoke counter stop.....	At front end of pole.....		
1	Neck yoke counter stop pin.....	do.....		
1	Neck yoke counter stop spring.....	do.....		
1	Neck yoke stop.....	do.....		
1	Pole body.....	Seated in front end of middle rail.....		
1	Pole plug.....	In front end of pole.....		
1	Pole pin bushing.....	In pole body at pin.....		
1	Ammunition chest, complete, consisting of:			
39	Ammunition chest connecting pieces.....	Rolled into rear and middle diaphragms.....		
1	Axe handle support.....	Riveted to right side of chest.....		
1	Axe head fastener.....	do.....		
1	Bottom plate, right.....	Forms part of chest bottom.....		
1	Bottom plate, left.....	do.....		
1	Bucket holder.....	Riveted to bucket holder transoms.....		
2	Bucket holder transoms, right.....	Riveted to top of chest.....		
2	Bucket holder transoms, left.....	do.....		
2	Chains, door.....	Fastened to door and handrail shanks.....		
2	Chains, No. 11.....	Fastened to door.....		
4	Diaphragm reinforces.....	Riveted to diaphragms at side rails.....		
1	Door.....	Forms back of chest.....		
2	Door chain fasteners.....	Riveted to door.....		
1	Door frame.....	do.....		
4	Door hinges, male.....	do.....		
4	Door hinges, female.....	Riveted to bottom of chest.....		







## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Ammunition chest, complete, consisting of—Continued.			
4	Door hinge pins.....	In hinges.....		
1	Front diaphragm.....	Inside chest.....		
1	Front plate.....	Forms front of chest.....		
1	Front transom, right.....	Riveted to diaphragms.....		
1	Front transom, left.....	do.....		
1	Hand rail forward bracket, right.....	Riveted to side of chest.....		
1	Hand rail forward bracket, left.....	do.....		
1	Hand rail rear bracket, right.....	do.....		
1	Hand rail rear bracket, left.....	do.....		
2	Hand rail tubes.....	Riveted to hand rail brackets.....		
1	Hatchet blade bracket.....	Riveted to left side of chest.....		
1	Hatchet handle fastener.....	do.....		
1	Lantern bracket body.....	Riveted to front plate.....		
1	Lantern bracket bottom.....	Riveted to bracket body.....		
2	Lantern strap fasteners.....	do.....		
2	Lock bars.....	Hinged in lock bar bearings.....		
2	Lock bar bearings, right.....	Riveted to top plate.....		
2	Lock bar bearings, left.....	do.....		
1	Middle diaphragm.....	Inside chest.....		
2	Middle transoms, right.....	Riveted to diaphragms.....		
2	Middle transoms, left.....	do.....		
1	Padlock, No. 850.....	Chained to door.....		
1	Pick guard, chisel point.....	Riveted to left side of chest.....		
1	Rear diaphragm.....	Inside chest.....		
1	Rear transom, inner, right.....	Riveted to diaphragms.....		
1	Rear transom, inner, left.....	do.....		
1	Rear transom, outer, right.....	do.....		
1	Rear transom, outer, left.....	do.....		
78	Reinforce pieces.....	Soldered to connecting pieces.....		
4	Strap fasteners, No. 1.....	For axe and paulin straps.....		
16	Strap fasteners, No. 5.....	For blanket and picket rope straps.....		
3	Strap fasteners, No. 7.....	For grip and paulin straps.....		
3	Strap fasteners, No. 12.....	For hatchet and shovel straps.....		
1	Top plate.....	Forms top and sides of chest.....		
2	Top plate front fillers.....	Riveted to side rails.....		
2	Top plate rear fillers.....	do.....		
2	Wing nuts.....	Fastened to door plate.....		
2	Wing nut pins.....	Riveted to door plate.....		
2	Wing nut pin washers.....	On wing nut pins.....		

IV 3

## DESCRIPTION OF THE 3-INCH GUN CAISSON LIMBER, MODEL OF 1916.

[Plates XVII and XVIII.]

As in the 3-inch gun limber, model of 1902, the model of 1916 limber is of metal throughout, excepting the spokes and felloes of the wheels. The principal parts of the limber are the wheels, axle, frame, ammunition chest, pole, doubletree, singletrees, and neck yoke. Of these parts all are the same as described for the earlier model of limber except the frame and ammunition chest.

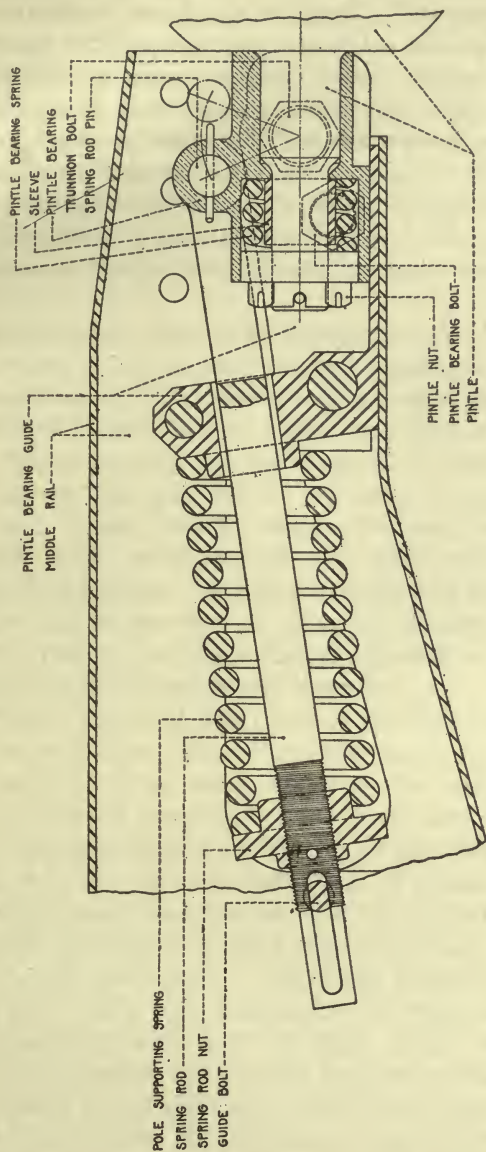
The frame consists of a middle and two side rails. The middle rail is in the form of a split cylinder, one half passing below and the other half above the axle. The two halves are united in front to form a pole seat and in rear to form a seat for the pintle-bearing guide. Two axle brackets are clamped about the axle near the axle arms with two bolts each, and are provided with lugs. Tie rods, two in front and two in rear, are pinned to these lugs and attached to the front and rear ends of the middle rail, thus rigidly bracing the pole and pintle seat. To the front end of the middle rail is



riveted the pole clamp, a steel collar, split on one side and provided with a clamping bolt for drawing the two halves of the middle rail firmly about the pole. A seat for the doubletree is formed on top of the pole clamp; the doubletree bolt projects up through this seat and through the doubletree; its upper end is threaded for a nut and is braced back to the middle rail by a doubletree strap. Riveted to the lower side of the pole clamp is the prop bracket, which is connected to the prop, a steel tube provided with a bronze foot, by the prop eye. When not in use, this prop is swung up under the frame by a chain, which is attached to the lower end of the tube by a prop-chain fastening, and reaches up through the foot rest, where it terminates in a prop-chain handle. It is held in the raised position by hooking the handle over a prop-chain button provided on the foot rest for that purpose.

When limbered up with another vehicle, this limber has in its pintle and pintle bearing an automatic pole support. The pintle hook has a lug formed on its lower side, which projects backward and bears against the underside of the lunette on the drawn vehicle, thus preventing the vertical rotation of the pintle. The pintle-bearing guide is a steel yoke fixed in the rear end of the middle rail. The pintle bearing is of bronze, pivoted to the guide by two trunnion bolts; it is bored out to receive the shank of the pintle and is counter-bored in front for the pintle-bearing spring. The latter, assembled about a sleeve fitting over the pintle shank, is compressed between a pintle nut and the pintle bearing, and absorbs the shock of starting. The sleeve checks the movement of the pintle nut before the spring becomes compressed solid. On top of the pintle bearing is formed a lug, to which is pinned one end of a spring rod, the other end of which is threaded for a spring rod nut and slotted to receive a guide bolt that passes through the middle rail near the axle. This spring rod, guided in the rear by a vertical wall of the pintle-bearing guide, through which it passes, and in the front by the guide bolt through the slot, as stated, is drawn backward by the relative action of the pintle bearing on its trunnions, and in doing so compresses the pole-supporting spring, which is assembled about it, between the spring rod nut and the vertical wall of the pintle-bearing guide. When the limber pole is dropped, the pintle tends to rise. Being held down, however, by the lunette in it, the pintle bearing is forced to swing on its trunnion bolts and draw the spring rod backward, thus compressing the pole-supporting spring until the reaction of the spring is sufficient to support the pole.

The pintle has a swiveling motion of  $360^{\circ}$  upon its shank. The lunette of the drawn vehicle is retained upon the pintle hook by a pintle latch. The latter is pivoted upon the end of the pintle



AUTOMATIC POLE SUPPORT  
 VERTICAL SECTION

SCALE: INCHES





horn and is arranged to be held in either the open or closed position by the pintle latch spring. The latch is opened by the entering lunette but must be closed by hand. The spring is peened in its seat but may readily be driven out and a new one inserted if required.

The side rails are of channel shape, fitting down over the axle brackets and riveted thereto. The rear ends project slightly behind the chest to form steps for the use of cannoneers in mounting; the front ends are bent up to support the foot rest. To the middle portions are riveted the chest, which they support, and of which they form a part of the bottom. The foot rest is a perforated sheet of flange steel formed to shape and riveted to the side rails.

The ammunition chest is a rectangular steel box built up of sheet steel, formed to shape and riveted together. The front plate is flanged all around and is riveted through the flanges to the top plate, which forms the top, sides, and part of the bottom of the chest. The remainder of the bottom is formed by two bottom plates and by the side rails. The door is made of a steel plate riveted to a frame, which consists of a steel angle around the top and sides of the plate welded to a flat steel bar along the bottom edge of the plate. The door is hinged at the bottom and swings downward and to the rear to an approximately horizontal position, where it is held by two door chains, attached to the handrail shanks, and to the door by door-chain fasteners.

The front plate and the door of the chest are strengthened by vertical corrugations pressed into the metal, those in the chest door serving as shields for the primers of the cartridges. The door is held in its closed position by two lock bars, each hinged in two lock-bar bearings riveted to the top of the chest. A hasp and two eccentric lugs are formed upon each of these bars; in locking the door the lugs come into contact with the projecting leg of the upper door angle, pressing it inward, while the hasp engages a wing nut riveted to the door plate. The right lock-bar hasp has a spring padlock and a bolt snap attached by a chain to the door; the left one is fitted only with the bolt snap, which, when snapped in the wing-nut eye, serves to lock the hasp in position. A door handle is also riveted to the right side of the door plate.

Inside the chest the cartridges are supported by three vertical diaphragms, flanged all around and riveted to the body of the chest. Each diaphragm is perforated with 39 flanged holes. Between the diaphragms, riveted to them and supporting them, are 10 vertical plates called transoms, the lower ends of which are riveted to the middle and side rails. Other than as described the interior of the chest is the same as in the limber model of 1902.

On top of the chest, seats for three cannoneers are provided by a perforated sheet-metal bucket holder, supported by four bucket-holder transoms. The watering buckets are carried in the compartments thus provided for them between the seat and the chest. The paulin issued with each limber serves as a seat cushion, and is held in place by three paulin straps attached to strap fasteners, which are riveted to the bucket holder and the front of the chest. At each side of the seat is a handrail, which projects above the top of the chest, and which is riveted to the sides of the chest by means of handrail shanks. In strap fasteners riveted to the top of the chest behind the bucket holder are four blanket straps.

To the front plate of the chest are riveted a bracket for a lantern and fasteners for four picket-rope straps that secure two picket-ropes. To the paulin-strap fasteners riveted to the front of the chest are also attached three grip straps for the use of cannoneers on the chest seat. Under the foot rest is riveted a shovel handle support and under the chest are strap fasteners for a shovel-blade strap, which carry a short-handled shovel. On the right side of the chest are riveted an ax-head fastener, an ax-handle support, and a strap fastener, for carrying an ax, the handle to the front. On the left side of the chest are riveted a hatchet-blade bracket, a hatchet-handle fastener, and a strap fastener for securing a hatchet. Riveted to the foot rest are a pick-head fastener, a pick-handle fastener, a pick-mattock point guard, a pole-prop support, a pole-prop pocket, and the necessary strap fasteners for carrying a pickax and a pole prop. The head of the pickax projects slightly over the left side of the foot rest, and the ax end is supported by a pick guard, chisel end, riveted to the left side of the chest. The pole prop is the shape of a pair of tongs and is used to prop up the end of the pole to relieve the horses of the weight on the neck yoke.

With each limber are issued three oil cans, each of the general form of a cartridge and of a capacity of approximately two-thirds of a gallon. They are intended for hydroline, lubricating, and coal oil, and are to be carried inside the chest in the central vertical row of cartridge holes.

A name plate is riveted to the middle rail of each limber near the pintle seat, giving number, name of limber, model, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence the limber should be designated by the number, name, etc., as given on the name plate.* As repairs to implement attachments and other parts of the limber may from time to time be required, the parts needed should be referred to by the names given on the drawings or in the nomenclature of parts.



## THE 3-INCH GUN CAISSON, MODEL OF 1916.

[Plates XIX, XX, and XXI.]

## WEIGHTS, DIMENSIONS, ETC.

Weight empty, without implements and ammunition.....	pounds..	1,384
Weight of tools and equipment carried.....	do.....	53.5
Weight of ammunition carried.....	do.....	1,312.5
Weight, completely equipped and loaded.....	do.....	2,750
Weight with limber, completely equipped and with 106 rounds of ammunition.....	pounds..	4,525
Rounds of ammunition carried.....	number..	70
Diameter of wheels.....	inches..	56
Width of track.....	do.....	60
Free height under caisson.....	do.....	21
Turning angle.....	degrees..	81

## NOMENCLATURE OF PARTS.

[Parts not enumerated in the following list are the same as those for the 3-inch gun caisson, model of 1902.]

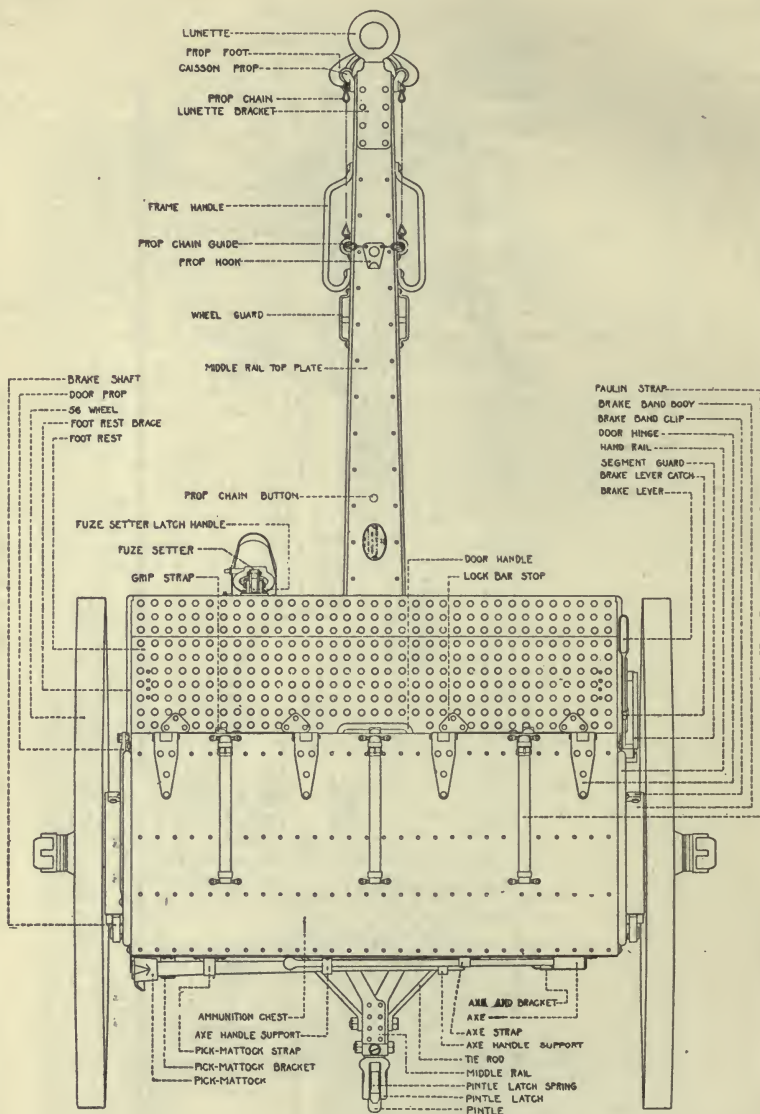
No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Middle rail, complete.....	Riveted to bottom of chest.....	IV	3
	Consisting of—			
1	Apron-hinge lug, center.....	Pivoted to middle rail.....		
2	Chain-guide pins.....	At wheel guards.....		
2	End reinforcers.....	On front end of middle rail.....		
1	Frame handle, right.....	Riveted to front end of middle rail.....		
1	Frame handle, left.....	do.....		
1	Fuze-setter bracket lug, inner.....	Riveted to middle rail.....		
1	Lunette, with nut and lock washer.....	Secured in lunette bracket.....		
1	Lunette bracket.....	Riveted to front end of middle rail.....		
1	Middle rail, right.....	Riveted to bottom of chest.....		
1	Middle rail, left.....	do.....		
1	Middle-rail top plate.....	Riveted to middle rails.....		
1	Middle-rail transom.....	Braces middle rail at wheel guards.....		
1	Name plate.....	On middle-rail top cover plate.....		
2	Prop chain guides.....	Riveted to middle rail.....		
1	Prop-chain button.....	On middle-rail top cover plate.....		
1	Shovel-blade bracket.....	Riveted to middle rail.....		
1	Tie-rod sleeve.....	Covers front tie-rod bolt.....		
2	Wheel guards.....	Riveted to middle rail.....		
2	Tie rods.....	Bolted to middle and side rails.....		
2	Side rails, complete.....	Support chest on axle.....		
	Consisting of—			
2	Apron-hinge lugs, end.....	On ends of front spring bolts.....		
2	Axle brackets.....	Clamped on axle.....		
16	Belleville springs.....	On spring rods below axle brackets.....		
1	Brake crank-shaft bearing, right.....	Riveted to right side rail.....		
1	Brake crank-shaft bearing, left.....	Riveted to left side rail.....		
4	Caisson-carrying springs.....	On spring bolts in side rails.....		
1	Fuze-setter bracket lug, outer.....	Riveted to side rail, left.....		
1	Side rail, right.....	Rides on axle bracket.....		
1	Side rail, left.....	do.....		
8	Side-rail liners.....	Riveted to side rails.....		
4	Spring bolts.....	In side rails and axle brackets.....		
2	Spring-bolt nuts.....	On ends of rear spring bolts.....		
1	Pintle, with bearing complete.....	Rear end of middle rail.....		
	Consisting of—			
1	Pintle.....	Seated in pintle bearing.....		
1	Pintle bearing.....	Rear end of middle rail.....		
2	Pintle bearing bolts, with nuts.....	Bolt pintle bearing to middle rail.....		
1	Pintle latch.....	On pintle.....		
1	Pintle-latch spring.....	do.....		
1	Pintle spring.....	In pintle bearing.....		
1	Pintle spring seat.....	do.....		
1	Spring plunger.....	do.....		
1	Pin, type A.....	Pivots latch to pintle.....		



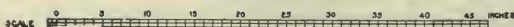
## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Caisson prop, complete.....	On front end of middle rail.....	IV	3
	Consisting of—			
2	Prop chains.....	Secured to prop.....		
2	Prop-chain clamps.....	On prop tubes.....		
1	Prop eye, right.....	Riveted to right tube.....		
1	Prop eye, left.....	Riveted to left tube.....		
1	Prop foot.....	In lower ends of tubes.....		
1	Prop hook.....	On chain.....		
2	Prop tubes.....	Support middle rail.....		
1	Fastening pin.....	Pins prop eyes to middle rail.....		
1	Washer nut.....	On fastening pin.....		
1	Ammunition chest, complete, consisting of—			
70	Ammunition-chest connecting pieces..	Connect rear and middle diaphragm perforations.....		
2	Axe handle supports.....	Riveted to chest back.....		
1	Axe head bracket.....	do.....		
2	Chains, No. 11.....	Fasten bolt snaps to door.....		
1	Chest angle.....	Riveted to chest back and body.....		
1	Chest back.....	Forms back of chest.....		
1	Chest top.....	Forms top and sides of chest.....		
4	Diaphragm reinforces.....	Support diaphragms over side rails.....		
1	Door.....	Hinged to top of chest in front.....		
1	Door angle.....	Riveted to lower edge of door inside.....		
1	Door handle.....	Riveted to door.....		
4	Door hinges, male.....	do.....		
4	Door hinges, female.....	Riveted to top of chest.....		
4	Door hinge pins.....	Pin male to female hinges.....		
1	Door prop.....	Holds door open.....		
1	Door-prop guide, right.....	On left side of chest.....		
1	Door-prop sliding rivet.....	Connects prop to guide.....		
1	Door-prop stud.....	Fastens prop to door.....		
7	Door tees.....	Riveted on inside of door.....		
1	Front diaphragm.....	Riveted in chest.....		
1	Front transom, inner, right.....	Braces diaphragms to middle rail.....		
1	Front transom, inner, left.....	do.....		
1	Front transom, outer, right.....	Braces diaphragms to side rail.....		
1	Front transom, outer, left.....	do.....		
2	Handrails.....	Riveted to handrail shanks.....		
4	Handrail shanks.....	Riveted to sides of chest.....		
4	Hinge reinforces.....	Inside chest at hinges.....		
1	Intermediate bottom plate, right.....	Forms part of chest bottom.....		
1	Intermediate bottom plate, left.....	do.....		
2	Lock bars.....	In lock-bar hinges.....		
4	Lock-bar hinges.....	Riveted to chest door.....		
1	Middle diaphragm.....	Riveted in chest.....		
2	Middle transoms, right.....	Riveted to diaphragms.....		
2	Middle transoms, left.....	do.....		
1	Outer bottom plate, right.....	Forms part of chest bottom.....		
1	Outer bottom plate, left.....	do.....		
1	Padlock No. 850.....	Chained to door.....		
1	Pick-mattock handle stop.....	Riveted to side of chest.....		
1	Pick-mattock head bracket.....	Riveted to chest back.....		
1	Rear diaphragm.....	Riveted in chest.....		
1	Rear transom, outer, right.....	Riveted to diaphragms.....		
1	Rear transom, outer, left.....	do.....		
1	Rear transom, inner, right.....	do.....		
1	Rear transom, inner, left.....	do.....		
140	Reinforce pieces.....	Soldered on connecting pieces.....		
14	Reinforce washers.....	Under door prop guide rivets.....		
13	Strap fasteners, No. 10.....	Riveted on chest.....		
2	Wing nuts.....	On chest door.....		
2	Wing nut pins.....	Fasten wing nuts to door.....		
2	Wing nut pin washers.....	Under wing nut pins.....		
4	Wrench holders.....	Riveted to chest back.....		
1	Foot rest, complete.....	Riveted to middle rail and chest.....		
	Consisting of—			
1	Apron latch base, right.....	On right side of foot rest.....		
1	Apron latch base, left.....	On left side of foot rest.....		
4	Apron latch base reinforces.....	On apron latch bases.....		
1	Foot rest.....	Riveted to middle rail and chest.....		
1	Foot rest brace, right.....	Braces foot rest to side of chest.....		
1	Foot rest brace, left.....	do.....		
1	Foot rest corner brace.....	Braces rear left corner of foot rest.....		
1	Foot rest reinforce, right.....	Riveted to foot rest at brace.....		
1	Foot rest reinforce, left.....	do.....		
1	Fuze setter latch base.....	Riveted to front of foot rest.....		
4	Lock bar stops.....	Riveted on foot rest.....		





3 INCH GUN CAISSON MODEL OF 1916  
PLAN





## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Band brake, complete, consisting of—			
2	Adjusting links.....	Pinned to brake band ends.....		
2	Adjusting nuts.....	Pinned to brake shafts.....		
4	Band clips.....	Riveted to brake hangers.....		
4	Band guides.....	Riveted to brake band bodies.....		
2	Brake band bodies.....	Around brake drums.....		
4	Brake band ends.....	Riveted to brake band bodies.....		
2	Brake band linings.....	Inside brake band bodies.....		
1	Brake crank.....	Keyed to brake crank shaft.....		
1	Brake crank shaft.....	In bearings on side rails.....		
2	Brake drums.....	Bolted to wheels at hubs.....		
1	Brake hanger, right.....	Clamped to axle, right end.....		
1	Brake hanger, left.....	Clamped to axle, left end.....		
1	Brake lever.....	On right end of brake lever shaft.....		
1	Brake-lever catch.....	On lever.....		
1	Brake-lever shaft.....	In bearing and in crank shaft.....		
1	Brake-lever shaft bearing.....	Bolted to chest and foot rest.....		
6	Brake pins.....	Pin brake-band ends to brake shaft.....		
2	Brake rods.....	Connect brake cranks and cranks, outer.....		
4	Brake-rod ends.....	On brake rods.....		
2	Brake shafts.....	Supported by brake hangers.....		
2	Cranks, outer.....	Fixed on brake shafts.....		
1	Segment guard.....	Riveted to chest side and foot rest.....		
1	Segment rack.....	do.....		
2	Separators.....	Separate guard and rack.....		
1	Apron, complete.....	Hinged under chest.....		
	Consisting of—			
1	Apron.....	Pinned to hinge lugs.....	IV	3
4	Apron hinges.....	Riveted on apron.....		
2	Apron-latch staples.....	do.....		
2	Apron latches, complete.....	Pivoted on bases on foot rest.....		
	Consisting of—			
2	Latch bodies.....	Pinned to bases.....		
2	Latch springs.....	In body around plunger.....		
2	Latch handles.....	Pivoted on bodies.....		
2	Plungers.....	Seated in bodies.....		
2	Pins, type A.....	Pin bodies to bases.....		
2	Pins, type A.....	Pin handles to bodies.....		
1	Fuze-setter bracket, complete.....	Hinged to middle and side rails.....		
	Consisting of—			
1	Fuze-setter bracket arm, right.....	Riveted to bracket end, right.....		
1	Fuze-setter bracket arm, left.....	Riveted to bracket end, left.....		
1	Fuze-setter bracket end, right.....	Pinned to lug, inner.....		
1	Fuze-setter bracket end, left.....	Pinned to lug, outer.....		
1	Fuze-setter bracket separator.....	Between ends of bracket arms.....		
1	Fuze-setter rod, lower.....	Pinned to bracket separator.....		
1	Fuze-setter rod, upper.....	Pinned to latch base.....		
1	Fuze-setter latch, complete.....	Pivoted on base on foot rest.....		
	Consisting of—			
1	Latch body.....	Pinned to base.....		
1	Latch spring.....	In body around plunger.....		
1	Latch handle.....	Pivoted on body.....		
1	Plunger.....	Seated in body.....		
1	Pin, type A.....	Pins body to base.....		
1	Pin, type A.....	Pins handle to body.....		

## DESCRIPTION OF THE 3-INCH GUN CAISSON, MODEL OF 1916.

[Plates XIX, XX, and XXI.]

As in the 3-inch gun caisson, model of 1902, the model of 1916 caisson is made of metal throughout, with the exception of the feloes and spokes of the wheels. The principal parts of the caisson are the wheels, axle, frame, brakes, and ammunition chest.

The wheels and wheel fastenings are interchangeable with those of the carriage and limber. The axle is similar in design and equal in cross section to the limber axle, but differs from it in the size and location of the lugs for the axle brackets and in the lugs for the brake hangers.

The frame consists principally of two side rails and a middle rail, braced by two tie rods and also by the ammunition chest, to which they are riveted, and of which they form a part of the bottom. The tie rods, one on each side of the middle rail, are bolted at their ends to the middle rail, opposite the front and rear parts of the wheels, and to the side rails near the axle. The middle rail is made of two pressed steel channels connected by a top cover plate, with the flanges overlapping in the rear to form a pintle seat, the front ends being securely riveted to a lunette bracket. In the latter a lunette is assembled by a lunette nut.

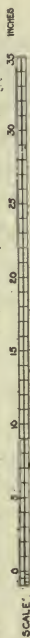
The side rails are of cast steel, the length of the chest. Each has two pairs of vertical guides that straddle the axle, fitted with bronze liners in which the axle bracket slides. Above and between these liners the side rail is bored out and tapped for the spring rod and counterbored for the caisson carrying spring. Clamped to the axle at each side rail with two fillister-head screws is an axle bracket, upon which are formed two lugs, bored out for the spring rod and counterbored for the caisson carrying spring. These lugs slide up and down between the side rail liners and hold the chest from lateral and longitudinal motion with respect to the axle. The four caisson carrying springs, assembled upon spring rods, are compressed between these lugs and the side rail, thus supporting the chest on the axle and allowing it 0.75 inch of movement. The upper end of each spring rod is screwed into the threaded portion of the side rail, where it is prevented from turning by a rivet; the lower end extends below the axle bracket lugs, where there are assembled upon it four Belleville springs, rings of flat spring steel, cupped to give them a slight spring action, held in place by a nut on the lower end of the rod. When the caisson is traveling over rough road the rebound of the chest from the caisson carrying springs is met by the action of the Belleville springs, which are compressed between the spring rod nuts and the axle bracket lugs, a maximum upward spring motion of 0.25 inch being thus available.

The nuts on the two front spring rods are made to serve as and are called apron hinge lugs, end. To these two lugs are pinned the end apron hinges. An apron hinge lug, center, made of flange steel and riveted to the middle rail, supports the remaining two of the four hinges by which the apron is hung. The apron itself is made of armor plate 0.15 inch thick and may be lowered into position in action or swung up to clear obstructions in traveling. When lowered it reaches from the axle to within 4.5 inches from the ground, and, in connection with the armored back and door of the chest, affords protection from small-arm and shrapnel fire to the ammunition servers in rear of the caisson. The apron, chest door, and chest back are made of the same quality of material as the carriage





BAND BRAKE AND CAISSON CARRYING SPRINGS



shields. For traveling, the apron is drawn up to the front and held by two apron latches.

Each apron latch consists principally of a latch body, handle, plunger, and spring. The apron latch body is pinned to an apron latch base riveted to the side of the foot rest; the lower end of the latch body terminates in a hook, which engages an apron latch staple riveted to the apron and holds the latter in traveling position. To retain the staple in the hook, the opening of the hook is closed by a plunger seated in the latch body and pressed outward into action by a coiled spring. By pressing the apron latch handle down with the hand, the plunger is first withdrawn from the hook, and then the hook is pushed backward, disengaging it from the apron latch staple.

The pintle bearing is of bronze, bored out to take the pintle shank, and is held in place by two bolts through the middle rail. The pintle has a swiveling motion of  $360^{\circ}$  upon its shank, but is kept in its normal position by the pintle spring in the pintle bearing, which presses a spring plunger against a flattened seat on the shank. The lunette of the drawn vehicle is retained upon the pintle hook by a pintle latch, which is pivoted by a pin upon the end of the pintle horn and is held in either the open or the closed position by the pintle-latch spring. Both the pintle latch and the pintle-latch spring are interchangeable with those on the limber. The latch is opened by the entering lunette, but must be closed by hand. The spring is peened in its seat, but may readily be driven out and a new one inserted, if desired.

Near the front end of the middle rail and riveted thereto are two frame handles and two wheel guards, the purpose of the latter being to present a wearing surface against which the limber wheels may rub in turning short, thus saving damage to the middle rail. Between the wheel guards, inside the middle rail, which it braces, is a stiffener called a middle-rail transom. A caisson prop, formed of two steel tubes united by a bronze foot, is hinged on a prop pin which passes through the middle rail and lunette bracket. When not in use, the prop is swung up against the middle rail and is held in that position by chains leading from the prop legs through guides on the middle rail, and uniting in a hook, which is engaged over a button riveted to the middle-rail top cover plate.

The caisson band brake is similar to that on the 3-inch gun carriage, model of 1916, and on the two vehicles the brake drum, brake-band lining, brake-band end, band clip, band guide, adjusting nut, and adjusting link are interchangeable. The brake-band bodies differ only in the placing of rivet holes for the band guides.

Bolted to the hub of each wheel, and revolving with it, is a brake drum of cast iron, shaped somewhat like a pulley, about the periphery

of which is a brake band, consisting of a steel band comprising about nine-tenths of a complete circumference, and lined with a strip of Raybestos or equivalent material. The brake-band ends, each with a pair of jaws formed on it, are riveted to the terminals of the brake band. To prevent the band from shifting or slipping off the drum, two small blocks, called brake-band guides, are riveted to the band body and work in brake-band clips. These are bronze castings radial from the axle, and are riveted to a brake hanger. The latter is a strut with a collar formed on one end, which is clamped on the axle by a bolt; the other end carries the brake shaft.

On the outer end of the brake shaft is formed a crank, one arm of which is pinned in the jaws of the upper brake-band end, while the other arm is connected to the lower brake-band end by an adjusting nut and link, which may be shortened or lengthened by screwing the nut in or out of the link. The inner end of the brake shaft is made square and carries the crank, outer, which is connected to the brake crank by a brake rod with two adjustable brake-rod ends. The two brake cranks are actuated by a brake-crank shaft, one of them being integral with it, the other being assembled to it by two feathers and a pin. The ends of the crank shaft are supported just inside the cranks by brake-crank shaft bearings, riveted to the side rails; the middle receives support from the flanged holes in the middle rail through which it passes. Assembled in the brake-crank shaft, which is tubular and has two diametrically opposite slots cut its entire length, is a solid brake-lever shaft, feathered only a few inches at its inner end, which extends to the middle of the crank shaft. Thus the torsional force in the lever shaft is transmitted to the crank shaft at the middle, thereby equalizing the effect on the two cranks. The brake-lever shaft, square on the right end to receive the brake lever, has its outer bearing in a triangular brake-lever shaft bearing, which is bolted to the chest side, the bottom plate, outer, and the foot rest; the inner end is carried in the crank shaft, as stated. The brake lever is placed convenient to the cannoneer riding on the right side, as it is just in front and to the right of the chest, extending forward and upward from the end of the brake-lever shaft. It has an angular travel of about  $60^{\circ}$ . For holding it in any set position, it carries a brake-lever catch, riveted near the lower end, which engages in the teeth of a segment rack, which, together with a similar quadrant of flange steel, called a segment guard, is riveted to the side of the chest and the foot rest. The rack and the tooth of the catch are case-hardened. Two separators at the ends of the segment hold the rack and the guard sufficiently apart for the lever to work between them.

When the brake lever is pulled up to a set position, the torsion produced in the brake-lever shaft is communicated to the brake-



crank shaft, and through it to the brake cranks. These, in turning, pull forward the cranks, outer, by means of the brake rods. The cranks, outer, turn the brake shafts, which, by means of the crank arms on their outer ends, draw the terminals of the brake bands closer together, clamping them tighter upon the revolving brake drums, and the resulting friction retards the rotation of the wheels.

The caisson ammunition chest is a rectangular steel box built up of flange steel, formed to shape and riveted together in a manner similar to the limber chest, but is larger, making provision for 70 rounds of ammunition arranged in 5 horizontal rows of 14 rounds each. The top and sides of the chest are comprised in one piece of flange steel, and the bottom is made up of four pieces, two outside the side rails, and two between the middle and side rails, called outer bottom plates, and intermediate bottom plates, respectively. The back of the chest is made of armor plate 0.15 inch thick. A steel angle is riveted to the armor plate all around its edge, and the projecting leg of the angle is riveted to the body of the chest.

Inside the chest the cartridges are supported by three vertical diaphragms, flanged all around and riveted to the body of the chest. Each diaphragm is perforated with 70 flanged cartridge holes. Corresponding holes in the front and middle diaphragms are connected by cylindrical brass connecting pieces similar in all respects to those used in the limber chest. The diaphragms are rigidly braced to each other and to the caisson frame by 12 transoms, which are securely riveted to the diaphragms, the middle and side rails, and also to the chest back, which they serve to stiffen. Riveted to the bottom of the rear and middle diaphragms and to the top of the side rails are four diaphragm reinforces made of flange steel angle, which help to transmit the load from the diaphragms to the side rails.

The chest door is made of armor plate 0.15 inch thick. It is hinged to the body of the chest at the top by four hinges, at each of which, inside the chest, is a hinge reinforce riveted to the chest top and middle and front diaphragms. The door is held closed by two lock bars hinged to the bottom of the door. A hasp and two eccentric lugs are formed upon each of these bars; in locking the door these lugs bear against an equal number of lock-bar stops riveted to the foot rest, thus pressing the door shut, while the hasp engages a wing nut higher up on the door. The right lock bar may be locked in position either by a spring padlock or a bolt snap, both of which are fastened by a chain to the door near the wing nut and engage in the eye of the latter; the left lock bar has only the bolt snap so attached.

Seven steel tees are riveted to the inner face of the door. These tees are spaced so that with the door closed the vertical leg of a T falls between each alternate row of cartridges, and the horizontal

legs press against the heads of the cartridges. The rims of the cartridge cases are thus firmly held between the front diaphragm and the door tees, which, in addition to forming stiffeners for the door, provide clearances between the door plate and the cartridge percussion cap, for the protection of the latter. The lower edge of the door is also stiffened by a steel angle running its entire length.

The door opens upward and forward, swinging through an arc of  $120^{\circ}$  to its open position, where it is held by a door prop on the left side of the chest. One end of the prop is secured with a nut on a door-prop stud riveted to the door; the other end runs in a door-prop guide riveted to the side of the chest. As the door is thrown open, the props catch in notches in the guides and hold it in the open position; to close the door the props must be released by hand from the guide notches. A door handle is riveted in the middle of the door at its lower edge.

The top of the chest forms a seat for cannoneers and has a hand-rail at each side. To one set of strap fasteners riveted to the door are attached three grip straps for the use of the cannoneers; and to another set riveted to the top of the chest are attached three paulin straps for securing the paulin, which serves as a seat cushion. In front of the chest is provided a foot rest, a perforated sheet-metal plate the width of the chest, formed to shape and riveted on; it is supported by the middle rail and by a foot-rest brace at each side, extending from the front corners of the foot rest up and back to the sides of the chest. The rear corners are strengthened, on the right side by the brake lever shaft bearing, and on the left side by a foot-rest corner brace, which is riveted to the side of the foot rest and to the chest.

The fuze-setter bracket consists of two angle irons united in the front to a bronze fuze-setter bracket separator, forming a seat, to which the fuze setter is securely bolted. In the rear the angles are hinged to brackets—one outer, which is riveted to the side rail, and one inner, which is riveted to the middle rail. A fuze-setter latch, pinned to a fuze-setter latch base, which latter is riveted to the front of the foot rest, engages a pin in the bronze separator mentioned above, and thus holds the bracket with fuze setter in traveling position. For use the fuze setter with bracket is released from the latch and swung down and supported by a jointed rod extending from the separator to the fuze-setter latch base. This jointed rod consists of an upper and a lower rod pinned together, and also pinned at both ends, the flexibility of the connection allowing the rod to fold up when the bracket is swung up for traveling.

The fuze-setter latch is the same as, and the parts are interchangeable with, the apron latch described above, with the exception of the handle, which, on the fuze-setter latch, is designed as a finger hold



to be lifted in releasing. This arrangement obviates the possibility of dropping down the fuze setter by accident.

A long-handled shovel is carried under the middle rail, the end of the handle resting in the lunette bracket, while the blade rests in a bracket riveted to the sides of the middle rail under the foot rest. The shovel is secured in position and held tightly against the middle rail by a leather strap passed around the handle near the blade and attached to the tie-rod bolt sleeve. On the back of the chest are carried an ax, resting in an ax-head bracket and an ax-handle support; a pick mattock, resting in a pick-mattock head bracket and an ax-handle support, the handle being prevented from coming out of the head by a pick-mattock handle stop, riveted to the side of the chest; and a spanner and a wrench, each carried in two wrench holders. These brackets are all riveted to the chest back, and all the implements are secured by leather straps, engaging in strap fasteners riveted to the chest back, those for the wrenches, however, being riveted to the intermediate bottom plates.

A name plate is attached to each caisson on the middle-rail top cover plate just in front of the foot rest, which gives the number, name of caisson, model, name of manufacturer, year of completion, and initials of inspector.

*In all reports and correspondence the caisson should be designated by the number, name, model, etc., given on this name plate.* In requests for spare parts for repairs, etc., the parts should be asked for by the names given on the plates or in the paragraph giving nomenclature of parts in this handbook.

### · CONVERTED 3-INCH LIMBER, MODEL OF 1908.

[Plate XXII.]

#### WEIGHTS, DIMENSIONS, ETC.

Weight, complete, empty	pounds	1, 050
Weight of tools and equipment	do	135
Weight of ammunition carried	do	770
Weight, completely equipped and loaded	do	1, 955
Weight of gun, carriage, and limber, completely equipped with 45 rounds of ammunition	pounds	4, 475
Rounds of ammunition carried in limber chest		41
Diameter of wheels	inches	57. 75
Width of track	do	60
Free height under limber (and carriage)	do	22
Turning angle with carriage	degrees	73
Turning angle with caisson	do	75



## NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section
1	Assembling bolt.....	On rear part of frame.....	IV	3
1	Ax chafing plate.....	Screwed to chest.....		
1	Ax-handle support.....	Bolted to top of chest.....		
1	Ax pocket.....	do.....		
1	Axle.....	do.....		
2	Bearing plate, 2 inches wide.....	Screwed to door.....		
2	Bearing plate, 2.5 inches wide.....	do.....		
1	Bolt, 0.75 inch by 4.7 inches.....	For pintle bearing.....		
1	Bolt, 0.75 inch by 5.6 inches.....	do.....		
4	Bolt, steel, square head machine, 0.375 inch by 2 inches.....	Secures hand rail to chest.....		
2	Bolt snap, 0.625 inch.....	For rear door.....		
1	Bushing.....	Forced in rear part of pole.....		
	Carriage bolts:			
22	0.187 ( $\frac{3}{16}$ ) inch by 1.25 inches.....	For chest.....		
16	0.187 ( $\frac{3}{16}$ ) inch by 1.5 inches.....	do.....		
12	0.25 inch by 3.25 inches.....	do.....		
1	0.25 inch by 1.5 inches.....	Secures ax-handle support to chest.....		
50	0.312 ( $\frac{5}{16}$ ) inch by 1.5 inches.....	For door attachments.....		
4	0.312 ( $\frac{5}{16}$ ) inch by 2.75 inches.....	For door prop guide.....		
	Cartridge case packing, intermediate:			
1	With finger notches at A.....	In chest.....		
2	With finger notches at B.....	do.....		
1	Cartridge case packing, upper.....	do.....		
1	Cartridge case packing, lower.....	do.....		
2	Chain.....	For doubletree.....		
2	Chain, 2.52 feet long.....	For chest door.....		
4	Chain ring.....	For chains.....		
2	Chain rivets.....	Riveted to chest door.....		
1	Chest back plate.....	Bolted to rear part of chest.....		
1	Chest body.....	Secured to frame.....		
1	Chest bracket, right.....	Riveted to side rails.....		
1	Chest bracket, left.....	do.....		
2	Chest straps.....	Bolt chest to frame.....		
1	Clamp bolt and nut.....	On sheathing clamp.....		
1	Copper sheathing.....	On pole.....		
1	Corner iron.....	On chest.....		
1	Corner post, right.....	do.....		
1	Corner post, left.....	do.....		
1	Cover.....	do.....		
1	Cross rail.....	Riveted to side and middle rails.....		
	Crown nuts:			
2	0.625 inch.....	For chest strap bolts.....		
2	0.75 inch.....	For pintle bearing bolts.....		
1	Door, woodwork, complete.....	On rear of chest.....		
1	Door handle.....	On door.....		
1	Door hinge, center, door strap.....	Bolted to chest.....		
1	Door hinge, center, lid strap.....	do.....		
2	Door hinge, end, door strap.....	do.....		
2	Door hinge, end, lid strap.....	do.....		
1	Door jamb, right.....	Part of door.....		
1	Door jamb, left.....	do.....		
2	Door prop.....	Attached to chest door and door-prop guide.....		
1	Door-prop guide, right.....	Bolted to side of chest.....		
1	Door-prop guide, left.....	do.....		
1	Doubletree.....	Fits on doubletree bolt and strap.....		
2	Door-prop rivet.....	Connect door prop to door prop stud.....		
1	Door-prop stud.....	Bolted to chest.....		
1	Doubletree bolt brace.....	Fits on doubletree bolt and strap.....		
3	Dowel, oak, 0.375 d.....	For door jamb.....		
1	End and stay hook, right.....	On doubletree.....		
1	End and stay hook, left.....	do.....		
2	End bracket.....	On footboard.....		
2	End link.....	On doubletree chain.....		
8	Filler piece.....	On chest.....		
1	Footboard.....	Secured to front of frame.....		
1	Footboard compartment, right.....	Under footboard.....		
1	Footboard compartment, left.....	do.....		
2	Footboard hinge.....	Riveted to footboard.....		
1	Footboard latch and strap.....	On footboard.....		
2	Front stay.....	Bolted to front of chest.....		
2	Hand rail.....	Bolted to side of chest.....		
	Hatchet blade bracket:			
1	Body.....	Bolted to front of chest.....		
1	Handle rest.....	do.....		
1	Hatchet handle rest.....	do.....		
1	Lantern bracket body.....	do.....		
1	Lantern bracket bottom.....	Riveted to lantern body.....		

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section
2	Lantern strap fastener.....	On lantern bracket body.....	IV	
2	Linchpin.....	On end of axle.....		
2	Linchpin and clasp.....			
2	Linchpin spring.....			
2	Linch washer.....			
1	Lock bar, right.....	On chest door.....		
1	Lock bar, left.....	do.....		
4	Lock bar hinge.....	Bolted to bottom of chest.....		
2	Lock-bar plate, 2.42" long.....	On chest.....		
2	Lock-bar plate, 2.75" long.....	do.....		
1	Middle-rail bracket, right.....	Riveted to middle rail.....		
1	Middle-rail bracket, left.....	do.....		
1	Middle rail.....	Seated on axle.....		
1	Middle-rail brace, front.....	Riveted to middle and side rails.....		
1	Middle-rail brace, rear.....	do.....		
1	Middle-rail understrap.....	Secures axle to middle rail.....		
1	Middle-rail understrap bolt.....			
1	Name plate.....	Riveted to middle rail.....		
1	Neck-yoke stop.....	Secured to understrap of pole.....		
Nuts:				
52	0.187 ( $\frac{3}{16}$ ) inch.....	For carriage bolt.....		
24	0.25 inch.....	do.....		
8	0.25 inch.....	For tire bolt.....		
54	0.312 ( $\frac{5}{16}$ ) inch.....	For carriage bolt.....		
4	0.375 inch.....	For machine bolt.....		
10	0.375 inch.....	For tie rod.....		
2	0.5 inch.....	For door prop stud.....		
6	0.625 inch.....	For understrap bolts.....		
1	0.75 inch.....	For doubletree bolt.....		
4	Packing corner iron.....	Screwed to corner of packing.....		
8	Packing support, middle, 2.16 wide.....	Between chest packing.....		
8	Packing support, middle, 2.25 wide.....	do.....		
1	Packing support, side, right.....	Secured to side of chest.....		
1	Packing support, side, left.....	do.....		
1	Padlock, No. 850.....	On chest door.....		
1	Pick mattock bracket.....	Riveted under rear of frame.....		
1	Pick mattock handle support.....	do.....		
1	Pickax support.....	Riveted to side rail.....		
1	Pintle.....	Fits in pintle bearing.....		
1	Pintle bearing.....	Bolted to middle rail.....		
1	Pintle latch.....	Pinned to pintle.....		
1	Pintle latch pin.....	Joins pintle latch to pintle.....		
1	Pintle latch spring.....	On pintle latch.....		
2	Plate.....	Bolted to chest door.....		
1	Pole body.....	Secured to frame.....		
1	Pole bolt.....	On middle rail.....		
1	Pole ferrule.....	On front end of pole.....		
1	Pole pad.....	do.....		
1	Pole pad band.....	Attached to pole pad.....		
1	Pole prop carrier, right.....	Riveted to side rail.....		
1	Pole-prop carrier, left.....	do.....		
1	Pole stop.....	Riveted to middle rail.....		
1	Projectile packing, intermediate.....	In chest.....		
1	Projectile packing, upper.....	do.....		
1	Projectile packing, lower.....	do.....		
1	Prop chain.....	Attached to prop.....		
1	Prop-chain button.....	Riveted to foot board.....		
1	Prop-chain fastening.....	Riveted to prop tube.....		
1	Prop-chain handle.....	Secured to prop chain.....		
1	Prop eye.....	Pinned to top of prop.....		
1	Prop foot.....	Pinned to bottom of prop.....		
1	Prop tube.....	Forms body of prop.....		
1	Rear brace, right.....	Riveted to side and middle rails.....		
1	Rear brace, left.....	do.....		
4	Separator.....	On doubletree.....		
1	Sheathing clamp.....	Clamped to pole.....		
1	Shovel blade bracket.....	Secured under frame.....		
1	Shovel handle bracket.....	do.....		
1	Side rail, right.....	Part of frame.....		
1	Side rail, left.....	do.....		
2	Side rail and chest bolt, front.....	Joins side rail to chest.....		
2	Side rail and chest bolt nut.....	On side rail and chest bolt.....		
2	Side rail brace rod, forward.....	Riveted to side and middle rails.....		
1	Side rail filler plate, right.....	Riveted to side rail.....		
1	Side rail filler plate, left.....	do.....		
1	Side rail understrap, right.....	do.....		
1	do.....	do.....		
1	Side rail understrap, left.....	do.....		
4	Side rail understrap bolt.....			

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
4	Side rail washer.....	On side rail understrap bolts.....	IV	3
	Split ribs:			
2	0.093 ( $\frac{1}{8}$ ) inch by 0.75 inch.....			
1	0.156 ( $\frac{1}{4}$ ) inch by 1 inch.....			
4	0.156 ( $\frac{1}{4}$ ) inch by 1.5 inches.....			
2	Staples.....	On side rails.....		
	Strap fasteners:			
1	No. 1.....			
2	No. 2.....			
3	No. 3.....			
12	No. 5.....			
9	No. 10.....			
2	Tie rod, 18 inches long.....	Secure packing to chest.....		
2	Tie rod, 42.3 inches long.....	do.....		
66	Washer, brass.....	For No. 6 wood screw.....		
2	Washer, leather.....	For wheel.....		
2	Washer, steel.....	For 0.187 ( $\frac{1}{8}$ ) inch rivets.....		
10	Washer, steel, 0.375 inch.....	For tie rods.....		
8	Washer, steel, 0.5 inch.....	do.....		
2	Wheels, complete.....			
2	Wing nut.....	On wing nut pin.....		
2	Wing nut pin washer.....	do.....		
2	Wing nut pin.....	Riveted to chest body.....		

## DESCRIPTION OF THE CONVERTED 3-INCH LIMBER, MODEL OF 1908.

[Plate XXII.]

The limber is of metal throughout except the chest body, pole, footboards, and spokes and felloes of the wheels. The principal parts are the ammunition chest, axle, frame, pole, doubletree, singletrees, neck yoke, and wheels.

The ammunition chest is a rectangular wooden box with aluminum and wooden packing for holding 41 rounds of ammunition and three oil cans. A steel back plate is riveted to the rear of the chest which is perforated and forms a stop for the rims of the cartridge cases. The chest door is hinged at the bottom and opens downward and to the rear. A door prop and various implement fastenings are attached to the chest. The chest is covered with heavy cotton duck.

The axle is hollow and of wrought tubular steel, 3 inches in diameter,  $\frac{3}{8}$ -inch walls. Upon it are shrunk three square forgings with chamfered corners. One of these 6 inches long is at the middle of the axle and one  $9\frac{3}{8}$  inches long is at each end inside the wheel spindles, the outer part forming the shoulders.

The frame, which consists of a middle rail, two side rails, and braces, is seated upon the squared part of the axle and is secured thereto by understraps.

The pole is of wood and has a copper sheathing, a leather pole pad on the forward end and a neck-yoke stop on its underside. The pole is also provided with a folding prop.







The doubletree is made of steel and is mounted upon the double-tree bolt. This bolt is part of the doubletree bolt strap, being forged solid therewith.

The singletrees are of steel and shaped similar to the doubletree. The wheels are of the Archibald pattern,  $57\frac{3}{4}$  inches in diameter.

### CONVERTED 3-INCH CAISSON, MODEL OF 1908.

[Plate XXIII.]

#### WEIGHTS, DIMENSIONS, ETC.

Weight, empty, without implements and ammunition	pounds	1,300
Weight of tools and equipment carried	do	90
Weight of ammunition carried	do	825
Weight, complete, equipped and loaded	do	2,215
Weight with limber, completely equipped and with 44 rounds of ammunition	pounds	4,170
Rounds of ammunition carried	number	44
Diameter of wheels	inches	57.75
Width of track	do	60
Free height under caisson	do	24
Turning angle	degrees	75

#### NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Ammunition chest (woodwork, complete).	On top of frame.	IV	3
1	Apron.	Hinged under frame.		
2	Apron hinge, center.	Riveted to apron.		
1	Apron hinge, side, right.	do.		
1	Apron hinge, side, left.	do.		
1	Apron-hinge bracket, center, right.	Riveted to middle rail.		
1	Apron-hinge bracket, center, left.	do.		
2	Apron-hinge bracket, side.	Riveted to siderail.		
2	Apron staple.	Riveted on apron.		
2	Arm attachment (brake).	Bolted to brake arm.		
2	Arm attachment screw bolt.	Bolts arm attachment to brake arm.		
1	Ax chafing plate.	Top of chest.		
2	Ax-handle support.	do.		
1	Ax-pocket body.	do.		
1	Ax-handler rest.	do.		
1	Axle.			
2	Bearing plate, 2 inches wide.	Screwed to door.		
4	Bearing plate, 2.5 inches wide.	do.		
1	Blocking (middle rail).	Over axle in middle rail.		
2	Blocking (side rail).	Over axle in side rail.		
8	Bolt, steel, square head, machine, 0.375 inch by 2 inches.	Connect hand rails to chest.		
2	Bolt snap, 0.625 inch.	On chains riveted to door.		
2	Bracket.	Between under strap and middle rail.		
1	Bracket hinge.	Riveted to side rail, right.		
1	Bracket-hinge bolt, right.	Bolts arm of fuze-setter bracket to bracket.		
1	Bracket-hinge bolt, left.	Bolts arm of fuze-setter bracket to middle rail.		
1	Brake arm, right.	Hinged on brake-arm hinge bolt.		
1	Brake arm, left.	do.		
1	Brake-arm hinge bolt.	Hinges brake arms to middle rail.		
1	Brake-arm hinge piece.	Riveted to left brake arm.		
1	Brake lever, right.	Riveted on brake segment bracket, left.		
1	Brake lever, left.	Riveted on brake-segment bracket, right.		
2	Brake lever bolt and nut.	Holds brake levers on segment brackets.		



## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Brake segment, right.....	Riveted to brake-segment bracket, right.	IV	3
1	Brake segment, left.....	Riveted to brake-segment bracket, left.		
1	Brake-segment bracket, right.....	Clamped to axle.....		
1	Brake-segment bracket, left.....	do.....		
2	Brake-segment bracket bolt.....	Clamps segments to axle.....		
2	Brake shoe.....	Bolted to brake arm.....		
2	Brake-shoe screw bolts.....	Bolt shoes to brake arms.....		
	Bolts (carriage):			
13	0.187 ( $\frac{3}{16}$ ) inch by 1.25 inches.....	.....		
12	0.187 ( $\frac{3}{16}$ ) inch by 1.5 inches.....	.....		
6	0.187 ( $\frac{3}{16}$ ) inch by 2.25 inches.....	.....		
35	0.25 inch by 1.25 inches.....	.....		
	0.25 inch by 1.5 inches.....	.....		
7	0.25 inch by 2.25 inches.....	.....		
6	0.25 inch by 2.5 inches.....	.....		
12	0.25 inch by 3.25 inches.....	.....		
36	0.312 ( $\frac{5}{16}$ ) inch by 1.5 inches.....	.....		
6	0.312 ( $\frac{5}{16}$ ) inch by 1.75 inches.....	.....		
4	0.312 ( $\frac{5}{16}$ ) inch by 2.75 inches.....	.....		
1	Cartridge case packing.....	In chest, intermediate with finger notches at A.		
2	Do.....	In chest, intermediate with finger notches at B.		
1	Cartridge-case packing, upper.....	In chest.....		
1	Cartridge-case packing, lower.....	do.....		
2	Chain 2.52 feet long.....	Connected together and riveted to chest.		
4	Chain ring.....			
2	Chain rivet.....	Screwed onto packing.....		
1	Chest back plate.....	Screwed to side of chest, bolted to side rail.		
2	Chest strap.....	Screwed to corners of packing.....		
4	Corner iron.....	Inside chest, rear, right side.....		
1	Corner post, right.....	Inside chest, rear, left side.....		
1	Corner post, left.....	On top of chest.....		
1	Cover, duck.....	Bolted to side rails and middle rail.....		
1	Cover, leather (for pole strap).....	Bolted to rear ends side rails.....		
1	Cross rail, front.....	On side rail and chest bolt, front.....		
1	Cross rail, rear.....	Rear of chest.....		
2	Crown nut, 0.625 inch.....	Bolted to outer face of door.....		
1	Door (woodwork, complete).....	do.....		
2	Door end plate.....	do.....		
1	Door handle.....	Bolted to underside of lid top.....		
1	Door hinge, center, door strap.....	Bolted to outer face of door.....		
1	Door hinge, center, lid strap.....	Bolted to underside of lid top.....		
2	Door hinge, end, door strap.....	Rear end of right side of chest.....		
2	Door hinge, end, lid strap.....	Rear end of left side of chest.....		
1	Door joint, right.....	Bolted to outer face of door.....		
1	Door joint, left.....	do.....		
1	Door plate, right.....	On door prop studs.....		
1	Door plate, left.....	Riveted to outside of chest, right side.....		
2	Door prop, A=17.562 (17 $\frac{3}{16}$ -inch).....	Riveted to outside of chest, left side.....		
1	Door prop guide, right.....	Runs in door prop guide attached to end of door prop.		
2	Door prop guide, left.....	Riveted to end of door.....		
2	Door prop sliding rivet.....	In door joints.....		
2	Door prop stud, H=4 inch.....	At ends of packings.....		
6	Dowel, 0.375 inch.....	Secured to footboard brackets.....		
8	Filler piece.....	Secured to middle and side rails.....		
1	Footboard.....	Riveted to front of middle rail, right side.		
3	Footboard bracket.....	Riveted to front of middle rail, left side.		
1	Frame handle, right.....	Inner face of front of chest.....		
1	Frame handle, left.....	Bolted to bottom of chest, bears against front shield.		
1	Front shield.....	do.....		
1	Front shield cleat, bottom.....	Bolted to front of chest.....		
2	Front shield cleat, side.....	Attached to side rail and middle rail, under right side of chest.		
2	Front stay.....	Bolted to sides of chest.....		
1	Fuze setter bracket (2 pieces).....	Between chest and hand rails.....		
2	Hand rail.....	Pivoted in hanger clip.....		
4	Hand rail reinforce.....	Riveted to middle rail.....		
1	Hanger.....	Riveted to rear cross rail.....		
1	Hanger bolster.....	Riveted on brake arms.....		
1	Hanger clip.....			
2	Hanger filler plate.....			

## NOMENCLATURE OF PARTS—Continued.

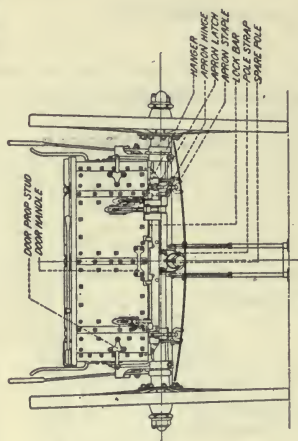
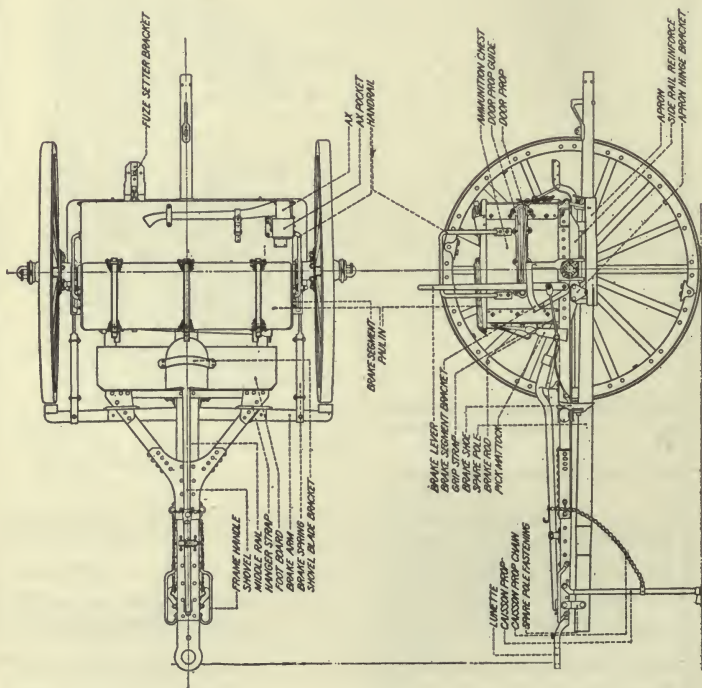
No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Hanger pin.....	Pins link to hanger, other pins hanger to hanger clip.	IV	3
2	Hanger straps.....	Bolts to brake arms.....		
4	Hanger strap bolt.....	Bolt hanger strap to brake arms.....		
4	Hinge pin.....	In apron hinges.....		
1	Insert.....	Riveted in lunette.....		
2	Latch bracket.....	Riveted to rear cross rail.....		
2	Latch handle.....			
2	Latch hook.....			
2	Latch lock.....	Assembled and pivoted in latch bracket.		
2	Latch pin.....			
2	Latch spring.....			
2	Linch pin.....	Secures wheel on axle.....		
2	Linch-pin spring.....	In linch pin.....		
2	Linch washer (2 pieces).....	On axles.....		
1	Link.....	Pivoted in hanger clip and fuze setter bracket.		
1	Lock bar (right).....	In lock-bar hinges.....		
1	Lock bar (left).....	do.....		
4	Lock-bar hinge.....	Bolted to bottom of chest.....		
1	Lunette.....	Secured in front of middle rail.....		
1	Middle rail (in halves).....	Riveted and bolted, forms main part of frame.		
1	Middle-rail bolt, .625 inch by 6.25 inches...	Passes through middle rail and middle rail bracket, intermediate.		
1	Middle-rail bracket, front, right.....	Riveted to middle rail and cross rail front.		
1	Middle-rail bracket, front left.....	do.....		
1	Middle-rail bracket, intermediate, right.....	do.....		
1	Middle-rail bracket, intermediate, left.....	do.....		
1	Middle-rail bracket, rear right.....	Riveted to middle rail and cross rail rear right side.		
1	Middle-rail bracket, rear left.....	Riveted to middle rail and cross rail rear left side.		
1	Middle-rail reinforce, right.....	Riveted inside middle rail at prop-chain guide.		
1	Middle-rail reinforce, left.....	do.....		
1	Middle-rail separator.....	Between parts of middle rail.....		
1	Middle-rail top plate.....	Riveted to middle rail and side rails.....		
	Nails.....	Secure wedges and filler pieces to chest sides and packings.		
1	Name plate.....	Attached to left side rail.....		
	Nuts, steel, for carriage bolts:			
31	0.187 ( $\frac{3}{16}$ ) inch.....			
61	0.25 inch.....			
46	0.312 ( $\frac{5}{16}$ ) inch.....			
2	Nut, steel, special, 0.5 inch (for door prop stud).....			
8	Nut, steel, square, 0.375 inch (for machine bolt).....			
	Nuts, steel, standard:			
8	0.25 inch (for tire bolt).....			
10	0.375 inch.....			
10	0.5 inch.....			
2	0.5 inch, for bracket-hinge bolt, left.....			
3	0.625 inch.....			
1	0.625 inch, for brake arm hinge bolt.....			
2	0.625 inch, for spare pole fastening bolt.....			
2	0.625 inch, for understrap bolt.....			
4	Packing corner iron.....	On corners of packing.....		
8	Packing support, middle, A = 2.16.....	Between packing.....		
8	Packing support, middle, A = 2.25.....	do.....		
1	Packing support, side, right.....	At right ends of packings.....		
1	Packing support, side left.....	At left ends of packings.....		
1	Padlock No. 850 with clevis and clevis rivet.....	Fastened to padlock chain.....		
1	Pick-matlock guard.....	Front of chest.....		
1	Pick-matlock support.....	do.....		
1	Pin, bronze.....	Connects end of link with separator in fuze setter bracket.		
	Pins, steel:			
2	0.156 ( $\frac{1}{4}$ ) inch, D.....	In latch lock.....		
2	0.187 ( $\frac{3}{16}$ ) inch, D.....	In brake-lever bolt.....		
2	0.25 inch, D.....	In latch handle.....		
3	0.375 inch, D.....	Hinge pins connecting lid straps and door straps.		
1	Pole strap.....	Riveted on rear of middle rail.....		
3	Projectile packing, intermediate.....	In supports in chest.....		
1	Projectile packing, upper.....	do.....		

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Projectile packing, lower.....	In supports in chest.....	IV	3
2	Prop chain, A=29.75.....	Connected to prop-chain eyes and prop hook.....		
1	Prop-chain button, A=1.875.....	Assembled in lunette.....		
2	Prop-chain clamp.....	On prop tubes.....		
2	Prop-chain guide.....	Riveted to middle rail top plate.....		
1	Prop eye, right.....	Riveted in prop tube, upper end.....		
1	Prop eye, left.....	do.....		
1	Prop foot.....	Riveted to lower ends of prop tubes.....		
1	Prop hook.....	Connected to upper ends of prop chains.....		
1	Prop pin.....	Connects prop eyes to middle rail.....		
1	Prop-pin washer.....	On end of prop pin.....		
2	Prop tube.....	Riveted to lower ends of prop tubes.....		
2	Rivet, Norway iron, countersunk head 0.187 ( $\frac{3}{16}$ ) by 0.875 inch.....	Connect linchpin spring with linchpin.....		
	Rivets, steel, button-head:			
2	0.187 ( $\frac{3}{16}$ ) by 0.375 inch.....			
3	0.187 ( $\frac{3}{16}$ ) by 0.5 inch.....			
2	0.187 ( $\frac{3}{16}$ ) by 0.812 ( $1\frac{1}{8}$ ) inch.....			
4	0.187 ( $\frac{3}{16}$ ) by 0.875 inch.....			
2	0.187 ( $\frac{3}{16}$ ) inch by 1.562 ( $1\frac{5}{8}$ ) inches.....			
2	0.187 ( $\frac{3}{16}$ ) inch by 1.625 inches.....			
2	0.25 by 0.875 inch.....			
2	0.25 by 0.937 ( $\frac{3}{8}$ ) inch.....			
2	0.25 inch by 1.125 inches.....			
6	0.25 inch by 1.625 inches.....			
4	0.25 inch by 1.937 ( $1\frac{1}{8}$ ) inches.....			
2	0.312 ( $\frac{5}{16}$ ) inch by 1.187 ( $1\frac{1}{8}$ ) inches.....			
4	0.312 ( $\frac{5}{16}$ ) inch by 1.25 inches.....			
4	0.312 ( $\frac{5}{16}$ ) inch by 1.312 ( $1\frac{1}{8}$ ) inches.....			
10	0.375 by 0.875 inch.....			
4	0.375 by 1 inch.....			
1	0.375 inch by 1.25 inches.....			
42	0.375 inch by 1.375 inches.....			
10	0.375 inch by 1.437 ( $1\frac{7}{8}$ ) inches.....			
18	0.375 inch by 1.5 inches.....			
6	0.375 inch by 1.625 inches.....			
4	0.375 inch by 1.687 ( $1\frac{1}{4}$ ) inches.....			
4	0.375 inch by 1.812 ( $1\frac{5}{8}$ ) inches.....			
10	0.375 inch by 1.875 inches.....			
14	0.5 inch by 1.125 inches.....			
2	0.5 inch by 1.187 ( $1\frac{5}{8}$ ) inches.....			
28	0.5 inch by 1.625 inches.....			
12	0.5 inch by 1.687 ( $1\frac{1}{4}$ ) inches.....			
2	0.5 inch by 1.75 inches.....			
	Rivets, steel, countersunk head:			
4	0.187 ( $\frac{3}{16}$ ) inch by 1.25 inches.....			
2	0.312 ( $\frac{5}{16}$ ) inch by 1.937 ( $1\frac{1}{8}$ ) inches.....			
4	0.375 inch by 1.25 inches.....			
2	Rods.....	Connected to brake levers and springs.....		
2	Rod bolt.....	Connect rod and brake levers.....		
2	Screw, steel, countersunk head, 0.25 by 0.5 inch standard.....			
1	Separator.....	Riveted between arms of fuze setter bracket.....		
1	Shovel-blade bracket.....	Riveted to footboard.....		
1	Shovel-handle pocket.....	Riveted to middle rail.....		
1	Side rail, right.....	Connected to right ends of cross rails and right side of middle rail.....		
1	Side rail, left.....	Connected to left ends of cross rails and left side of middle rail.....		
2	Side rail and chest bolt, front.....	Secures front of chest to side rails.....		
2	Side rail and chest bolt nut.....	On side rail and chest bolt, front.....		
1	Side-rail bracket, front right.....	Riveted to cross-rail front and right side rail.....		
1	Side-rail bracket, front left.....	Riveted to cross-rail front and left side rail.....		
1	Side-rail bracket, rear right.....	Riveted to cross-rail rear and right side rail.....		
1	Side-rail bracket, rear left.....	Riveted to cross-rail rear and left side rail.....		
1	Side-rail reinforce, right.....	Riveted to right side rail.....		
1	Side-rail reinforce, left.....	Riveted to left side rail.....		
1	Side-rail top plate, right.....	Riveted to top of right side rail at bend.....		
1	Side-rail top plate, left.....	Riveted top of left side rail at bend.....		
1	Sleeve.....	On brake-arm hinge bolt.....		
2	Spare pole fastenings.....	Bolted on middle rail.....		
1	Spare pole fastening bolt, A=4.....	Holds pole in fastening.....		







CONVERTED 3-INCH CAISSON  
MODEL OF 1908

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Spare pole fastening bolt, A=5.5.....	Joins fastening to middle rails.....	IV	3
	Split pins:			
2	0.093 ( $\frac{3}{32}$ ) by 0.75 inch.....			
2	0.125 by 0.75 inch.....			
2	0.125 by 0.875 inch.....			
2	0.125 by 1 inch.....			
3	0.156 ( $\frac{5}{16}$ ) by 0.75 inch.....			
2	0.156 ( $\frac{5}{16}$ ) by 1.5 inches.....			
1	0.187 ( $\frac{3}{8}$ ) by 0.875 inch.....			
2	Springs.....	Connected with arm attachments and rods.		
4	Spring assembling bolts.....	Connect springs to arm attachments and rods.		
	Strap fasteners:			
3	No. 1.....	1 on chest top, 2 on chest front.....		
3	No. 3.....	Chest front.....		
8	No. 10.....	Chest top and middle rail.....		
8	Tie rods, A=18.....	Connect packing to chest.....		
2	Tie rods, A=42.3.....	do.....		
8	Tire bolts, 0.25 inch by 3 inches.....	Connect chest straps to chest.....		
1	Understrap.....	Bolted to middle rail, holds axle.....		
2	Understrap bolts.....	Holds understrap to middle rail.....		
	Wagon-box rivets:			
4	0.187 ( $\frac{3}{8}$ ) inch by 1.312 ( $1\frac{1}{8}$ ) inches.....			
3	0.187 ( $\frac{3}{8}$ ) inch by 2.375 inches.....			
2	0.25 inch by 1.75 inches.....			
2	0.25 inch by 2.437 ( $2\frac{7}{8}$ ) inches.....			
2	0.25 inch by 3.375 inches.....			
8	0.312 ( $\frac{5}{8}$ ) inch by 1.937 ( $1\frac{15}{16}$ ) inches.....			
2	Washers, leather, for wheel.....	On axle.....		
1	Washer, steel.....	On brake arm hinge bolt.....		
1	do.....	On bracket hinge bolt.....		
10	Washers, steel, 0.375 inch.....	On tie rods.....		
8	Washers, steel, 0.5 inch.....	do.....		
7	Washers, steel.....	On tire bolts for chest straps.....		
4	do.....	Under shovel blade bracket rivet.....		
16	Wedges.....	Between filler pins and side of chest.....		
2	Wheels, complete.....	Same as on carriage.....		
3	Wing nuts.....	Assembled and attached to chest door.....		
3	Wing-nut pin washers.....			
3	Wing-nut studs.....			
	Wood screws, brass, round head:			
65	0.75 inch, No. 6.....			
9	0.125 inch, No. 10.....			
	Wood screws, steel:			
48	0.75 inch, No. 6.....			
4	1 inch, No. 6.....			
34	1 inch, No. 8.....			
57	1.25 inches, No. 12.....			
6	2.75 inches, No. 14.....			
1	2.75 inches, No. 14.....	On bracket hinge bolt.....		

## DESCRIPTION OF THE CONVERTED 3-INCH CAISSON, MODEL OF 1908.

[Plate XXIII.]

The construction of the caisson is very similar to that of the limber. The side and middle rails are longer and the latter terminate at the front in a lunette by which the caisson is coupled to its limber. The caisson is furnished with two lever road brakes, each of which operates separately, so that either or both wheels can be affected. The brake arms, steel angles, are pivoted at the middle rail by the brake arm hinge bolt and extend out to the rear of the wheels. They are supported by a hanger strap on the side rails. On the outer ends are cast-iron brake shoes.



A spare pole is carried under the middle rail on each of four caissons in a battery.

A fuze-setter bracket which is made of steel is hinged to the side and middle rails.

### 3-INCH GUN AND 3.8-INCH HOWITZER, FORGE LIMBER, MODEL OF 1902.

#### WEIGHTS, DIMENSIONS, ETC.

Weight, empty, without equipment.....	pounds..	958
Weight, complete, equipped and loaded.....	do.....	1,577
Weight of forge limber and battery wagon, both complete, equipped and loaded.....	pounds..	4,324
Diameter of wheels.....	inches..	56
Width of track.....	do.....	60
Free height under limber.....	do.....	26.5
Turning angle with battery wagon.....	degrees..	75

#### NOMENCLATURE OF PARTS.

[Parts not enumerated in the following list are the same as those for the 3-inch gun limber, model of 1902.]

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Forge limber chest, complete, consisting of—			
1	Back and left end.....	Part of body.....		
1	Front and right end.....	do.....		
1	Bottom.....	do.....		
1	Lid.....	Hinged to body.....		
1	Lid stiffener.....	On lid.....		
4	Chest-rail filler pieces.....	Riveted to body and chest rail.....		
1	Outer left-hand partition.....	Part of body.....		
1	Inner left-hand partition.....	do.....		
1	Inner right-hand partition.....	do.....		
1	Outer right-hand partition.....	do.....		
1	Longitudinal partition (right).....	do.....		
1	Longitudinal partition (left).....	do.....		
1	Left rear corner angle.....	do.....		
1	Right front corner angle.....	do.....		
2	Bottom stiffening angles.....	do.....		
2	Corner-tie pieces.....	do.....		
2	Filler pieces.....	Part of body under hand-rail brackets.....		
2	Shot-bolt stops.....	Riveted to body.....		
1	Shot-bolt bracket (right).....	do.....		
1	Shot-bolt bracket (left).....	do.....		
2	Shot-bolt filler pieces.....	do.....		
1	Hasp.....	do.....	IV	9
1	Hasp hinge.....	Riveted to lid.....		
1	Hasp-hinge pin.....	In hinge.....		
1	Padlock-chain rivet.....	Riveted to body.....		
1	Chest rail (right).....	do.....		
1	Chest rail (left).....	do.....		
1	Shot bolt (right).....	In brackets on chest body.....		
1	Shot bolt (left).....	do.....		
1	Shot-bolt hasp (right).....	Riveted to lid.....		
1	Shot-bolt hasp (left).....	do.....		
1	Wing-nut pin.....	Riveted to chest body.....		
1	Wing nut.....	Riveted on pin.....		
1	Wing-nut pin washer.....	On pin.....		
1	Wing-nut pin washer, large.....	Between pin and chest body.....		
1	Padlock, with chain and bolt snap.....	Eye rivet on chest body.....		
4	Lid hinges.....	Riveted to lid and body.....		
4	Lid-hinge pins.....	do.....		
4	Hand-rail brackets.....	Riveted to body of chest.....		
2	Hand-rail tubes.....	Connect hand-rail brackets.....		
1	Lid-prop bracket.....	Riveted to lid.....		
1	Lid-prop guide (left).....	Riveted to chest partition.....		
1	Lid prop.....	Riveted on lid-prop bracket.....		
1	Lid-prop rivet.....	Rivets lid prop to bracket.....		

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Forge limber chest, complete, consisting of—Continued.			
1	Lid-prop sliding rivet.....	Riveted on lid prop.....		
1	Ratchet-drill fastening, No. 1.....	Riveted to outer right-hand partition..		
1	Ratchet-drill fastening, No. 2.....	Riveted to inside of chest back.....		
1	Forge-legs fastening, No. 1.....	Riveted to inner right-hand partition..		
1	Forge-legs fastening, No. 2.....	do.....		
1	Screw-wrench fastening, No. 1.....	Riveted to outer right-hand partition..		
1	Screw-wrench fastening, No. 2.....	do.....		
1	Chisel (cold iron) fastening.....	Riveted to inside of right end.....		
1	Chisel (hot iron) fastening.....	do.....		
1	Flatter fastening.....	do.....		
1	Hand-hammer fastening.....	Riveted to outer right-hand partition..		
2	Fore punch and creaser fastenings.....	Riveted to inside of left end.....		
1	Shoeing-rasp fastening, No. 1.....	Riveted to inner right-hand partition..		
1	Shoeing-rasp fastening, No. 2.....	do.....		
1	Flat bastard file fastening.....	Riveted to inner left-hand partition.....		
1	Taps and dies fastening, No. 1.....	Riveted to inside of back of chest near left end.		
1	Taps and dies fastening, No. 2.....	Riveted to inside of front of chest near left end.		
1	Square fastening, No. 1.....	Riveted to underside of lid near center, front.		
1	Square fastening, No. 2.....	Riveted to underside of lid near center, rear.		
1	Square fastening, No. 3.....	Riveted to underside of lid near right end, rear.		
1	Riveting hammer fastening.....	Riveted to outer right-hand partition..		
1	Shoeing hammer fastening.....	do.....		
1	Clinching iron fastening.....	do.....		
1	Hardie fastening.....	Riveted to inside of right end.....		
1	Oiler fastening.....	Screwed to anvil block.....		
3	Portable forge fastenings.....	Riveted to underside of lid.....		
1	Forge gear wheel fastening, No. 1.....	Riveted to inner left-hand partition.....	IV	9
1	Forge gear wheel fastening, No. 2.....	Riveted to lid-prop bracket and lid.....		
2	Anvil fastenings.....	Riveted to lid.....		
1	Sledge handle bracket.....	Riveted to bottom of chest.....		
1	Ax head bracket.....	do.....		
2	Front oil-can supports.....	do.....		
2	Middle oil-can supports.....	do.....		
2	Rear oil-can supports.....	do.....		
2	Oil-can support cover.....	Hinged to rear oil-can supports.....		
2	Sash cord.....	Fastened to oil-can support cover.....		
2	Oil-can support latches.....	On covers.....		
2	Latch pins.....	do.....		
2	Oil-can support latch springs.....	On latches.....		
1	Wooden packing for forge (4 blocks).....	In chest.....		
1	Wooden packing for anvil.....	do.....		
1	Wooden packing for small tools.....	do.....		
1	Wooden packing for rivet sets.....	do.....		
2	Wooden linings for horseshoe compartment, bottom.....	do.....		
4	Wooden linings for horseshoe compartment, side.....	do.....		
4	Wooden linings for horseshoe compartment, end.....	do.....		
1	Packing strap, rivet set.....	On packing for rivet sets.....		
2	Oil-can support hinges.....	Riveted to rear oil-can supports.....		
2	Cover hinge pins.....	Connects hinge and cover.....		
1	Foot rest, complete.....	Same as for 3-inch gun limber, except modification for carrying sledge.		
2	Foot-rest liner.....	Riveted to foot rest.....		
1	Sledge holder.....	do.....		
2	Sledge strap fasteners.....	do.....		
1	Name plate.....	On rear end of middle rail.....		

NOTE.—Other implement fastenings and bucket holder the same as on 3-inch gun limber.

DESCRIPTION OF THE 3-INCH GUN AND 3.8-INCH HOWITZER FORGE LIMBER,  
MODEL OF 1902.

The 3-inch gun and 3.8-inch howitzer forge limber, model of 1902, differs from the 3-inch gun limber, model of 1902, only in the construction of the chest and foot rest, which are fitted to carry the tools and



supplies pertaining to a farrier's shop, with the addition of some machinist's tools. The limber frame in all its parts is the same as those of the other limbers in the battery, and the chest is attached to the frame in a similar manner.

The forge-limber chest is a rectangular flange-steel box with chest lid on top. The lid is flanged all around, fitting over the body of the chest to make it water-tight. It is secured in front to the body of the chest by four hinges, and in rear it is held in its closed position by a shot bolt at each corner and by a hasp and wing nut in the middle. The shot bolts are seated in brackets riveted to the chest, while the shot-bolt eyes are riveted to the lid; the hasp is hinged to a hasp-hinge plate riveted to the lid, and the wing nut is attached to the wing-nut pin, riveted to the body of the chest. A spring padlock, fastened by chain and staple to the chest, may be passed through the eye of the wing nut to lock the chest lid when closed. Outside on top is a raised seat, fastened to the chest lid, with spaces underneath for carrying three watering buckets. The seat has a handrail at each end riveted to the chest body. Various strap fasteners for paulin straps, grip straps, picket-rope straps, etc., and brackets for carrying all the implements carried on other limbers are provided and are in all respects similar to those heretofore described for the 3-inch gun limber, except the ax-head bracket, which is slightly modified.

(One picket rope is issued for light batteries; two picket ropes are issued for horse batteries.)

Arrangements are also provided for carrying on each forge-limber chest one sledge and two oil cans. The sledge rests in a sledge holder riveted on the right end of the foot rest, with the handle projecting to the rear through a sledge-handle bracket riveted to the bottom of the chest. The oil cans are carried one under each end of the chest. For this purpose, for each can three flange-steel brackets, called the front, middle, and rear oil-can supports, are riveted to the bottom of the chest. The can is placed in the supports from the rear, and is retained in place by a bronze cover on the rear bracket. This cover is hinged at the bottom and held in close position by a spring latch. If desired, the latch may be more firmly secured in locking position by a split pin. The oil cans are similar to those carried on the 3-inch gun limber.

Inside, the forge chest is divided into five compartments by four vertical partitions reaching from front to rear. The end compartments are comparatively narrow and are fitted with fastenings for carrying smith's and machinist's tools, each so that it can be taken out without removing any other. The compartments next to the tool compartments are wider and are subdivided by lateral partitions forming two compartments for horseshoes and two for horseshoe nails, with a total capacity for 300 pounds of horseshoes and 50



pounds of nails. The horseshoes are carried loose in the compartment, which is wood lined; the horseshoe nails may also be carried loose, though the nail compartments are made of the proper size to take the 25-pound box of nails as issued. All of the partitions in the chest are made of flange steel, flanged on three sides and riveted through the flanges to the chest. The middle compartment is fitted to take the field forge in front, the anvil in rear, and several small tools in brackets on the walls. The anvil is bedded in a wooden seat on the bottom of the chest, and with the forge is held in place by cleats on the chest lid. The latter is held in its open position by a lid prop, which is hinged to a lid-prop bracket riveted to the underside of the lid and having at its other end a button running in a lid-prop guide riveted to one of the chest partitions.

#### FORGE LIMBER, MODEL OF 1902 MI.

The forge limber, model of 1902 MI., is the same as the forge limber, model of 1902, except that it has the identical automatic pole support used on the caisson limber, model of 1916.

#### CONVERTED 3-INCH FORGE LIMBER, MODEL OF 1908.

##### WEIGHTS, DIMENSIONS, ETC.

Weight, empty, without equipment.....	pounds.....	936
Weight complete, equipped and loaded.....	do.....	1, 555
Weight of forge limber and battery wagon, both complete, equipped and loaded.....	pounds.....	5, 965
Diameter of wheels.....	inches.....	57. 75
Width of track.....	do.....	60
Free height under limber.....	do.....	27
Turning angle with battery wagon.....	degrees.....	73

##### NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Anvil fastening.....	In chest.....	IV	9
1	Anvil packing.....	do.....		
2	Assembling bolt, 0.625 by 6.375.....	Through middle rail.....		
1	Ax chafing plate.....	Screwed to top of chest.....		
1	Ax-handle support.....	Riveted to top of chest.....		
1	Ax pocket.....	Screwed and bolted to top of chest.....		
1	Body.....			
1	Handle rest.....			
1	Axle.....			
1	Back stay.....	Riveted to chest.....		
1	Back-stay staple.....	On middle rail.....		
1	Bolt snap.....	On lock chain.....		
2	Bracerod, upper.....	Bolted to side and middle rails.....		
2	Brace rod, lower.....	do.....		
1	Bushing.....	Forced in rear end of pole.....		
2	Chain.....	Fastened to side rails.....		
1	Chain with chain rings.....	Fastened to chest, for bolt snap.....		
1	Chest body.....	Bolted to frame.....		
1	Chest lid.....	Hinged to chest body.....		
1	Clamp bolt and nut.....	On sheathing clamp.....		

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Cold-chisel bracket	In chest		
1	Copper sheathing	On pole		
10	Copper washers			
2	Corner plate, bottom	On corner of chest		
4	Corner plate, vertical	do		
3	Cover for hasp and hinge strap			
1	Cross rail	Riveted to side and middle rails		
1	Die-chest filler block	In chest		
2	Die-chest keeper	do		
1	Die-chest support, front	do		
1	Die-chest support, rear	do		
1	Doubletree	Bolted to middle rail		
1	Doubletree strap and bolt	Fastened to middle rail		
1	Doubletree-bolt brace	On doubletree bolt and fastened to middle rail		
1	Driving-tool retainer	In chest		
1	End and stay hook, right	On doubletree		
1	End and stay hook, left	do		
2	End bracket	On footboard		
2	End link	On doubletree chain		
1	File-handle attachment	Screwed in chest		
1	Flatter fastening	do		
1	Footboard	Secured to front of frame		
1	Footboard compartment:			
	Right	Under footboard		
	Left	do		
2	Footboard hinge	Riveted to footboard		
1	Footboard latch and strap	On footboard		
2	Forge chest bolt	Bolts through front stay		
1	Forge handle bracket	Fastened in chest		
1	Forge handle support	do		
2	Front stay	Riveted to front of chest		
2	Handle	Riveted to sides of chest		
4	Handle reinforce plate	Riveted inside of chest		
2	Handle support	Screwed in chest		
1	Hasp	Fastened to lid		
	Hatchet blade bracket:			
1	Body	Fastened to front of chest		
1	Handle rest	do		
1	Hatchet handle rest	do		
2	Hinge (with hinge strap)	Fastened to lid and chest body		
1	Horseshoer's tongs bracket	Fastened in chest		
1	Hot chisel fastening	do		
1	Lantern bracket body	Riveted to lantern bracket support		
1	Lantern bracket bottom	Riveted to lantern bracket body		
1	Lantern bracket support	Riveted to front of chest		
2	Lantern strap fastener	Riveted to lantern bracket body		
1	Lid prop, upper	Fastened to lid prop bracket		
1	Lid prop, lower	Fastened to lid prop pivot		
1	Lid prop bracket	Riveted to lid		
1	Lid prop bracket pivot	Assembled with lid prop bracket		
1	Lid prop plate	Riveted to chest body		
1	Lid prop plate pivot	Assembled with lid prop plate		
1	Lid prop strap hinge pin	Assembled with lid props, upper and lower		
2	Linch pin	In ends of axle		
2	Linch pin and clasp			
2	Linch pin spring	Fastened to linch pin		
2	Linch washer	On end of axle		
6	Lock washers			
1	Middle bracket	On foot board		
1	Middle rail	Seated on axle		
1	Middle rail brace	Riveted to middle rail		
1	Middle rail bracket, right	do		
1	Middle rail bracket, left	do		
1	Middle rail understrap	Bolted to middle rail		
1	Middle rail understrap bolt, front	In middle rail		
1	Middle rail understrap bolt, rear	do		
1	Name plate	Riveted to front cross member of frame		
1	Neck-yoke stop	Fastened to under side of pole		
	Nuts:			
11	.625			
2	.687 (11/16)			
1	.75			
1	Oiler fastening	In chest		
1	Padlock	Chained to chest		
2	Padlock staple	On chest body		
1	Pickax support			
1	Pick mattock bracket	Riveted under frame		

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Pick mattock handle support.....	Riveted to footboard compartment, left.	IV	9
1	Pincers and nippers fastening.....	Fastened in chest.....		
1	Pintle.....	Bolted to middle rail.....		
1	Pintle key.....	Chained to frame.....		
1	Pintle key chain.....	.....do.....		
1	Pole body.....	Fastened to frame.....		
1	Pole bolt.....	Fits in front end of middle rail.....		
1	Pole pad.....	Fastened to pole.....		
1	Pole pad band.....	.....do.....		
1	Pole prop carrier, right.....	Riveted to side rail, right.....		
1	Pole prop carrier, left.....	Riveted to side rail, left.....		
1	Pole stop.....	Riveted to middle rail.....		
1	Portable forge packing, right.....	In chest.....		
1	Portable forge packing, left.....	.....do.....		
1	Prop bracket.....	Riveted on doubletree strap.....		
1	Prop chain.....	Attached to prop and footboard.....		
1	Prop chain button.....	Riveted to footboard.....		
1	Prop chain button rivet.....	.....do.....		
1	Prop chain fastening.....	On prop.....		
1	Prop chain guard.....	On footboard.....		
1	Prop chain handle.....	On end of chain.....		
1	Prop eye.....	Fastened in prop bracket.....		
1	Prop foot.....	Pinned to prop tube.....		
1	Prop tube.....	Pinned to prop eye.....		
1	Ratchet handle keeper.....	Screwed in chest.....		
1	Ratchet head guide.....	.....do.....		
2	Round punch and pritchel bracket.....	.....do.....		
1	Safe plate.....	Riveted to rear of chest.....		
4	Separator.....	Riveted in doubletree.....		
1	Sheathing clamp.....	Bolted on pole.....		
4	Shim for 19C.....	In chest.....		
2	Shim for 19D.....	.....do.....		
1	Shovel blade bracket.....	Riveted to frame.....		
1	Shovel handle bracket.....	Riveted to footboard compartment, right.		
1	Side rail, right.....	Seated on axle.....		
1	Side rail, left.....	.....do.....		
2	Side rail bolt, front.....	Bolts side rail and understrap together.....		
2	Side rail bolt, rear.....	.....do.....		
2	Side rail brace bolt.....	Bolts brace to side rail.....		
1	Side-rail filler plate, right.....	Riveted to side rail.....		
1	Side-rail filler plate, left.....	.....do.....		
1	Side-rail understrap, right.....	Bolted to side rail, right.....		
1	Side-rail understrap, left.....	Bolted to side rail, left.....		
4	Side-rail washers.....	On side rails understrap bolts.....		
1	Sledge holder.....	Attached to footboard.....		
1	Square bracket.....	Screwed to underside of lid.....		
1	Square stop.....	.....do.....		
2	Staples.....	Riveted on side rails.....		
29	Strap fastener.....	Fastened on chest body.....		
15	Tacks, bronze.....	On pole body.....		
13	Tacks, copper.....	On chest body.....		
43	Tool attachments.....	In chest.....		
4	Transom rods and washers.....	Through chest body.....		
1	Turnbuckle.....	On turnbuckle pivot.....		
1	Turnbuckle pivot and washer.....	Riveted on back of chest body.....		
2	Turnbuckle pivot-plate rivets.....	.....		
1	Turnbuckle safe plate.....	Riveted on inside of chest, rear.....		
2	Washers, leather (for wheel).....	.....		
2	Washers, steel (for 0.187 inch ( $\frac{1}{16}$ inch) D wagon box rivets).....	On chest body.....		
13	Washers, steel (for 0.25 inch D wagon box rivets).....	.....		
1	Wearing shoe.....	On pintle.....		
2	Wheels (complete).....	.....		

## DESCRIPTION OF THE CONVERTED 3-INCH FORGE LIMBER, MODEL OF 1908.

The forge limber is constructed in the same manner as the converted limber for the carriage or caisson except that the packing for ammunition and oil cans is omitted. The forge limber carries



all the blacksmiths' tools except the anvil, vise, and sledge. Various fastenings are secured to the outside of the chest for carrying implements.

### 3-INCH GUN BATTERY WAGON, MODEL OF 1902.

[Plate XXIV.]

#### WEIGHTS, DIMENSIONS, ETC.

Weight of battery wagon, empty	.....pounds	1,244
Weight of battery wagon, completely equipped and loaded	.....do	2,747
Weight of forge limber and battery wagon, both completely equipped and loaded	.....pounds	4,324
Diameter of wheels	.....inches	56
Width of track	.....do	60
Free height under battery wagon	.....do	26
Turning angle	.....degrees	75

#### NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheels	Same as on carriage	IV	9
2	Wheel fastenings, complete	do		
1	Axle	do		
1	Axle block, center	Between axle and body		
1	Axle-block end (right)	do		
1	Axle-block end (left)	do		
1	Middle brace (right)	Riveted to axle and rail		
1	Middle brace (left)	do		
1	Side rail (right)	Riveted to axle lugs		
1	Side rail (left)	do		
1	Name plate	Riveted on left side rail		
1	Foot rest	On foot-rest brackets		
2	Foot-rest brackets, outer (right and left)	Bolted to front of body		
2	Foot-rest brackets, inner, with 4 bolts and nuts	do		
2	Foot-rest supports (right and left)	Tie outer corner of foot rest to end stiffeners		
1	Brake channel	Fastened to side rails		
2	Channel supports	do		
2	Outer channel supports	do		
1	Box bottom (right)	Riveted to ends of brake channel		
1	Box bottom (left)	do		
2	Brake-box fillers	do		
1	Brake-beam guide (right)	Riveted to brake channel		
1	Brake-beam guide (left)	do		
1	Front brake brace (right)	Braces channel to side rail		
1	Front brake brace (left)	do		
1	Rear brake brace (right)	do		
1	Rear brake brace (left)	do		
1	Cross brace	Riveted to side rails		
1	Cover	Over top of body		
1	Frame reinforce plate	Front end of side rail		
1	Frame handle, right	do		
1	Lunette bracket	do		
2	Lunette bracket filler plates	Riveted to bracket		
1	Lunette	In lunette bracket		
1	Lunette nut	On lunette		
1	Battery wagon prop, complete	Pivoted to lunette bracket		
	Consisting of—			
1	Prop eye (left)	All parts of prop are pinned or riveted together.		
1	Prop eye (right)			
2	Prop tubes			
1	Prop foot			
2	Prop-chain clamps			
1	Prop hook			
2	Prop chains and 2 rings			
2	Prop-chain guide	Riveted to cross brace		

## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Prop-chain button	Riveted to lunette bracket		
1	Prop fastening pin	Attaches prop to lunette bracket		
1	Prop-fastening washer nut			
2	Brake beams	Hinged in brake box		
2	Brake shoes	On ends of brake beams		
4	Brake-shoe tap bolts	Connect shoe to beam		
2	Brake-beam pins			
3	Brake-rod ends			
2	Brake rods			
2	Brake-rod springs			
2	Brake-spring covers			
2	Brake-spring cover heads			
2	Brake-spring cover ends			
6	Brake-rod pins			
2	Brake cranks	On brake shaft		
2	Brake-crank bolts and nuts	Join cranks to brake rods		
2	Brake-shaft bearings	On brake shaft		
2	Brake-shaft bushings	In bearings		
1	Brake-shaft bearing, right	Riveted to axle lug		
1	Brake shaft	In bearings on axle		
1	Brake-shaft crank	On right end of brake shaft		
1	Brake lever	On pivot on wagon body		
1	Lever rod	Connects brake-shaft crank and brake lever		
4	Handrail brackets	Riveted to forward lid		
2	Handrails	On handrail brackets		
1	Brake-lever catch	On brake lever		
1	Brake-lever pivot	Riveted on wagon body		
1	Brake-lever pivot backing	do		
1	Brake-pivot washer	On pivot		
5	Brake bolts	Fasten pivot to side of chest		
1	Brake segment	Attached to wagon body		
1	Segment rack	Riveted to brake segment		
1	Brake-segment bolt washer	Through brake segment, guard, upper separator, and body		
1	Brake guard	Attached to segment		
2	Brake-segment separators, upper	Between segment and guard		
1	Brake-segment separator, lower	do		
1	Oil-can front support	Riveted to side rails, rear of axle		
1	Oil-can middle support	do		
1	Oil-can rear support	do	IV	9
6	Oil-can support bolts	Tie supports to wagon body		
1	*Oil-can bar	Hinged to left side rail		
1	Oil-can bar buffer	On oil-can bar		
1	Oil-can bar bracket	Riveted to left side rail		
1	Oil-can bar staple	In bracket		
3	Oil-can locking plates	On oil-can bar		
1	Oil-can bar catch	Riveted to right side rail		
1	Padlock, chain and bolt snap	For locking bar on catch		
1	Filler plate	Riveted to right side rail		
3	Oil-can slats, wooden	On oil-can supports		
2	Oil-can slats, wooden	do		
1	Oil-can slat, wooden (right)	do		
1	Oil-can slat, wooden (left)	do		
1	Wagon body, woodwork			
6	Washers, square	Under heads of oil-can support bolts		
1	Center tie-rod	Horizontally through center of body		
1	Top tie-rod	Horizontally across top of body		
1	Vertical tie-rod, with 4 nuts and 2 washers	Vertically through center of body		
1	Side strap (right)	Vertically on sides of body		
1	Side strap (left)			
1	Corner iron, rear end (right outside)	Rear corners of body		
1	Corner iron, rear end (left outside)	do		
1	Corner iron, rear end (right inside)	do		
1	Corner iron, rear end (left inside)	do		
1	Corner iron, outside, front right	Front corners of body		
1	Corner iron, outside, front left	do		
1	Corner iron, inside, front right	do		
1	Corner iron, inside, front left	do		
4	Body fastening plates, with nuts	Fasten to side rails		
2	Lid stiffeners	Tee irons riveted to lids		
2	End stiffeners, with nuts and washers	Riveted to ends and extends through sides on new work; end tie-rods on repair work		
1	Vertical tie-rod washer	V-shaped washer near lower end of rod		
1	Floor plate (spare breech mechanism chest)	Screwed to upper floor		
2	Hinges for rear door	Hinge door to body		
6	Hinges, lid	For lids		
3	Hasps	For securing lids and rear door		

## NOMENCLATURE OF PARTS—Continued.

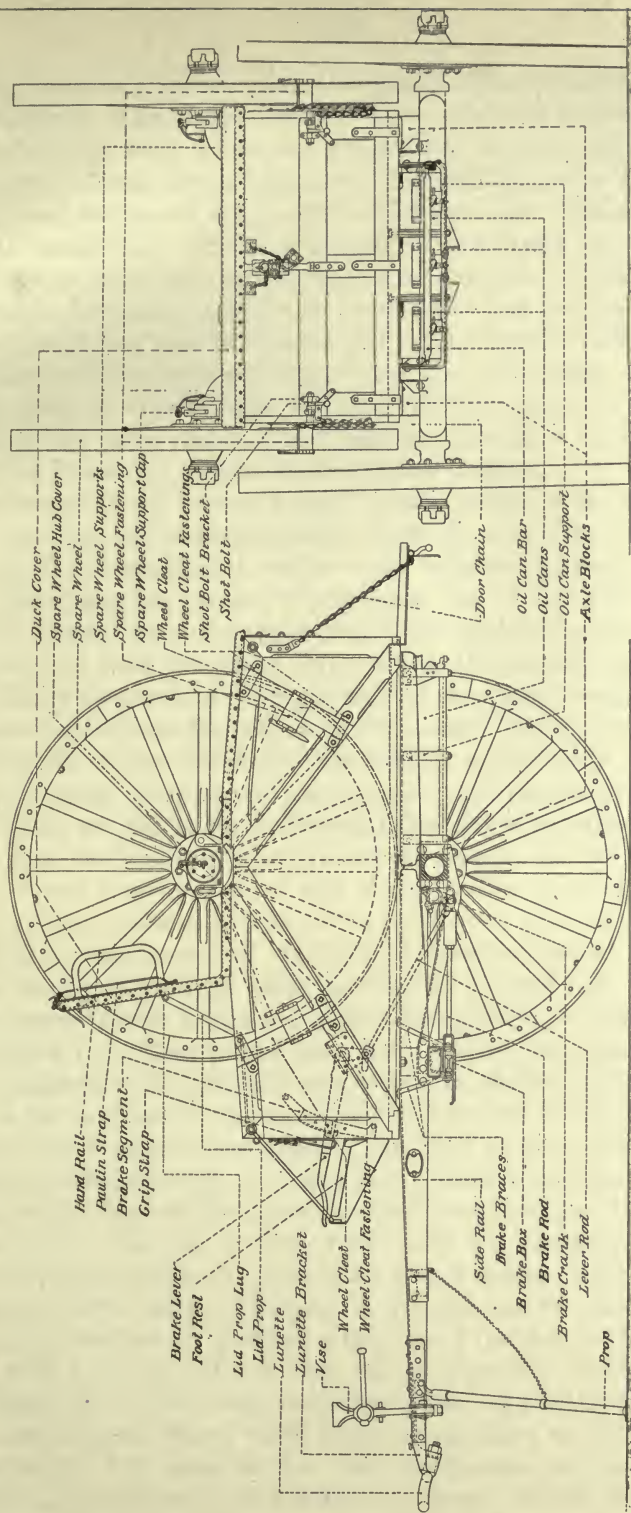
No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
9	Hasp rivets.....	Riveted to rear door.....	IV	9
1	Hasp plate.....	Riveted to lids.....		
2	Hasp plates.....	Riveted to lids.....		
3	Hasp staples.....	For securing lids and rear door.....		
3	Hasp-staple plates.....	Screwed to chest.....		
3	Lock-chain staples.....	For attaching padlock.....		
3	Lock-chain staple plates.....	Riveted to chest.....		
2	Bolt snaps.....	For lids.....		
3	Padlocks, with clevises and rivets.....	For locking lids and rear door.....		
2	3-inch chains for padlocks.....	For lids.....		
1	5-inch chain for padlock.....	For rear door.....		
1	Shot bolt (right).....	At corners of rear door.....		
1	Shot bolt (left).....	do.....		
1	Shot-bolt bracket (right).....	Screwed to rear door.....		
1	Shot-bolt bracket (left).....	do.....		
2	Shot-bolt eyes.....	Screwed to wagon body.....		
2	Shot-bolt stops.....	Screwed to rear door.....		
2	Chains.....	For rear door.....		
1	Chain fastening for door (right).....	Riveted to rear door.....		
1	Chain fastening for door (left).....	do.....		
1	Chain fastening for body (right).....	Attached to body.....		
1	Chain fastening for body (left).....	do.....		
2	Spare-wheel supports.....	Bolted on top of body.....		
2	Spare-wheel-support caps.....	On support.....		
2	Cap-hinge pins.....	For support.....		
8	Spare-wheel-support bolts, washers, and nuts.....	Secure supports to body.....		
2	Lock pins for spare-wheel supports.....	In spare-wheel supports.....		
4	Spare-wheel fastenings.....	Fastened to body.....		
	Consisting of—			
4	Spare-wheel fastening staples.....			
4	Spare-wheel fastening hinges (male).....			
4	Spare-wheel fastening hinges (female).....			
4	Spare-wheel fastening hooks.....			
12	Spare-wheel fastening pins.....			
4	Thongs.....	For spare-wheel fastenings.....		
8	Reinforce plates.....	Under wheel-cleat fastenings.....		
8	Wheel-cleat fastenings.....	Secure cleats to side of body.....		
16	Wheel-cleat strap bolts.....	Bolt straps to body.....		
4	Wheel cleats, wooden.....	On sides of body.....		
2	Lid-prop plates (right).....	Screwed to inside of body.....		
2	Lid-prop plates (left).....	do.....		
4	Lid props.....	Hold top lids open.....		
4	Lid-prop pins.....	Hold lid props to underside of lid.....		
1	Grindstone packing "A".....	On underside of rear lid.....		
1	Grindstone packing "B".....	do.....		
1	Grindstone packing "C".....	do.....		
1	Grindstone lower packing.....	On upper floor of body.....		
1	Grindstone frame pedestal.....	On lower packing.....		
1	Grindstone leg bracket, right end.....	On rear end of body.....		
1	Grindstone leg bracket, left end.....	do.....		
1	Grindstone packing nut.....	On packing stud.....		
1	Packing stud.....	In lower packing.....		
1	Jackscrew base packing.....	On upper floor of body.....		
2	Jackscrew handle packings.....	do.....		
2	Strap fasteners.....	do.....		
2	Grip-strap fasteners, No. 5.....	On body.....		
4	Paulin-strap fasteners, No. 10.....	do.....		

DESCRIPTION OF THE 3-INCH GUN BATTERY WAGON, MODEL OF 1902.

[Plate XXIV.]

The wheels, wheel fastenings, lunette, lunette bracket, frame handle, frame reinforce plate, channel support, brake braces, brake-box bottoms, brake-box filler plates, brake-beam guides, brake beams, brake shoes, brake-shoe tap bolts, brake-beam pins, brake-rod ends, brake rods, brake springs, spring covers, cover heads, cover ends, brake-rod pins, brake cranks with bolts, and two of the brake-shaft





3-inch Gun Battery Wagon Model of 1902



bearings are similar to and interchangeable with corresponding parts of the caisson. The frame consists of two side rails fastened together at the front to form a seat for the lunette bracket and projecting directly to the rear beyond the axle. The middle braces are fastened to lugs near the center on the axle and to the side rails at the brake channel connection. At the front end of the frame the left handle is omitted to permit the attachment of a forge vise, which is securely fastened and remains in place in traveling. The prop is pivoted on a pin through the lunette bracket and is A-shaped to afford greater steadiness to the unlimbered frame when the vise is used. For traveling the prop is drawn under the side rails by means of a chain attached to the prop crossbar and leading through a chain guide on the frame brace to a button on the lunette bracket.

The brake shoes, beams, boxes, guides, brake rods, cranks, and shaft bearings are interchangeable with those of the caisson. The brake shaft is assembled in the bearings with its right end supported in a special bearing riveted to the right lug of the axle. A brake crank is secured upon the right end of the shaft and is connected by the lever rod with the brake lever, which is mounted upon a lever pivot firmly attached to the right side of the battery-wagon body on a diagonal side brace front near its front end. A brake segment with ratchet teeth is also fastened to the battery-wagon body. The brake is set by raising the lever and engaging it in the segment rack. When released the weight of the lever holds the brakes unlocked. A brake guard upon the brake segment guides the lever in its motion.

The wagon body is of wood and is attached to the side rails of the frame by four bolts and nuts. The interior of the body is divided into four compartments, of which the largest is entered from either end on top, the openings being covered by hinged lids. The other three compartments are in the lower rear portion of the body, and are entered by a door at the rear end opening downward. Of the three compartments, the right one is for the saddler's chest, the left one for the carpenter's chest, and the middle one is for the cleaning materials and small-stores chest. The door to these compartments is held in closed position by a shot bolt at each corner and by a hasp hinged to the door at the center, secured over a staple riveted to the wagon body. The lids on top of the body are similarly secured by hasp and staple, and each is provided with a spring padlock attached by a chain to the body. The door in the rear has two door chains to hold it in a horizontal position when open; the lids on top are provided with lid props, one at each end of each lid. These lid props are hinged to lid-prop lugs fastened to the lid and having at their other ends buttons which work in guides fastened to the inner walls of the body. The sides of the body are framed and braced to the bottom, and are cross braced within by means of side straps, a ver-



tical and a horizontal tie rod, and two transverse braces, to give sufficient strength for carrying two spare wheels. These are secured in an upright position, one at each side, over the axle. The inner end of the wheel hub rests in a bronze spare-wheel support on top of the wagon body, and the wheel is further secured by two spare-wheel fastenings attached to the sides.

Axle blocks are added between the chest bottom and the axle for additional support under the spare wheels. A perforated foot rest is bolted to the front end of the chest and supported by two foot-rest brackets, inner, two foot-rest brackets, outer, and tie rods at each end called foot-rest supports. Two handrail brackets with hand-rails are riveted on each end of the front lid and two grip straps are provided on the front of the chest. Two paulin straps are secured in fasteners to the front lid of the body. Two grip straps are secured in fasteners to the front of the wagon body.

The grindstone and frame, the jackscrew, and the packing chest containing the spare breech mechanism, are carried in suitable fastenings inside of the wagon body and over the compartments for saddler's and carpenter's chests.

In rear of the axle under the wagon body are carried three oil cans, each of a capacity of 5 gallons. For this purpose transverse metal straps are riveted to the side rails and support longitudinal wooden slats upon which the cans rest. The cans are made of heavy sheet brass. Each is provided with a filling hole on top and with a special stopcock closed by a nozzle screw plug at the rear end. The stopcock is placed so that oil may be conveniently drawn from the can without removing the latter from the wagon. A wooden bar bears against the rear end of the cans and holds them in place.

The carpenter's chest is an iron-bound wooden chest and contains a complete assortment of carpenter's tools, so arranged that each tool can be taken from its place in the box without removing any other. The saddler's chest is a combined tool chest and stitching horse. For the latter purpose the box forming the seat rests upon four hinged legs, cross braced to each other. The stitching clamp is secured in a socket on one end of the chest, while the door swinging open on the left side brings the tools into convenient reach of the saddler. For transportation the clamp is removed from its seat and placed within the chest, the legs are folded over against each end and held by the leg braces, permitting the chest to be carried in a small compartment. Both the carpenter's and the saddler's chests are provided with handles and locks.

The middle compartment at the rear of the wagon body takes a wooden chest with a hinged lid containing perishable material and various small stores for the artificer's use. Included in these items are sal soda, thread, wax, nails, buckles, screws, tacks, rivets, burrs, etc.

One chest for spare sights is issued to each battery and is transported in the battery or store wagon. This chest provides for the safe packing of one front sight, complete, with bracket; one rear-sight bracket, with shank socket; one shank, complete; one panoramic sight; one range quadrant; one combined teat wrench and screw driver; one bore sight, breech, and one bore sight, muzzle, complete.

For batteries equipped with steel poles, a spare pole is carried under the frame of the battery and store wagons.

### CONVERTED 3-INCH BATTERY WAGON, MODEL OF 1908.

[Plate XXV.]

#### WEIGHTS, DIMENSIONS, ETC.

Weight of battery wagon, empty.....	pounds..	1, 244
Weight of battery, completely equipped and loaded.....	do.....	4, 410
Weight of forge limber and battery wagon, both completely equipped and loaded.....	pounds..	5, 965
Diameter of wheels.....	inches..	57. 75
Width of track.....	do.....	60
Free height under battery wagon.....	do.....	26
Turning angle.....	degrees..	73

#### NOMENCLATURE OF PARTS.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Axle.....	Fastened beneath frame.....	IV	9
1	Brake arm, right.....	Underneath rear cross bar and bolted at middle rail.		
1	Brake arm, left.....			
2	Brake arm attachments.....	Bolted to brake arm.....		
1	Arm hinge piece.....	Riveted to brake arm, right.....		
15	Bolts, 0.25 by 2.5.....	Assembled with carpenter's and saddler's chests.		
3	Bolts, 0.25 by 2.....	Assembled with saddler's chest.....		
2	Bearing strips.....	On bottom of chest.....		
1	Blocking.....	Between axle and middle rail.....		
2	do.....	Between axle and side rails.....		
1	Body tie strap.....	Through center of chest.....		
1	Body woodwork.....	Bolted to frame.....		
4	Bolt snap.....	On padlock chains.....		
2	Brake arm bolt.....	Bolts brake arm attachment to brake arm.		
2	Brake guard stop spring.....	Riveted to brake guard.....		
1	Brake lever, left.....	Pinned on brake lever pivot, left.....		
1	Brake lever, right.....	Pinned on brake lever pivot, right.....		
2	Brake lever catch.....	Riveted to brake lever.....		
2	Brake lever pivot.....	Riveted to side of chest.....		
2	Brake lever pivot backing.....	Riveted to inside of chest.....		
2	Brake link.....	Pinned to brake lever and spring.....		
2	Brake link pin.....	Assembled with brake lever and brake link.		
2	Brake pivot washer.....	Fits on brake lever pivot.....		
1	Brake segment, right.....	Riveted and bolted to chest.....		
1	Brake segment, left.....	do.....		
2	Brake segment bolt.....	Holds brake segment to chest.....		
2	Brake segment guard.....	Riveted and bolted to brake segment.....		
2	Brake segment stud.....	Fits through brake segment and brake segment guard.		
2	Brake segment stop spring.....	Riveted to brake segment.....		
2	Brake separator.....	Fits on brake segment bolt between brake segment and guard.		
2	Brake shoes.....	Bolted on end of brake arm.....		
2	Brake shoe screw bolts.....	Holds shoe to arm.....		
1	Brass turnbuckle.....	Riveted to body, rear.....		
2	Cap hinge pin.....	Fits in spare wheel support.....		



## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Carriage bolts:			
4	0.187 inch ( $\frac{3}{16}$ ) by 2.375 inches.....	Bolt jack-screw handle packing to chest		
2	0.187 inch ( $\frac{3}{16}$ ) by 4.2 inches.....	Bolt jackscrew base packing to chest..		
1	Center bolt.....	Fastened to side of chest body.....		
4	Chest cleat.....	Bolted to chest body, for fastening saddler's and carpenter's chests.		
2	.....do.....	Bolted to chest body.....		
4	Chain.....	Fastens bolt snap to body.....		
8	Chain ring.....	Part of bolt snap fastening.....		
1	Coal oil can fixture.....	Screwed to cover board.....		
1	Corner strap, right.....	Riveted and screwed to rear right, lower corner of chest.		
1	Corner strap, left.....	Riveted and screwed to rear left, lower corner of chest.		
1	Cover.....	Stretched and fastened over top of chest body and lids.		
2	End tie rod.....	One at each end of chest body.....		
2	Filler strip.....	Screwed to cover board in chest body.		
1	Floor plate.....	Fastened to cover board.....		
2	Front bolt.....	On inside of body fastened to side of chest body.		
1	Front corner brace, right.....	Front end of chest body.....		
1	Front corner brace, left.....	.....do.....		
1	Front cross bar.....	Riveted to side and middle rails.....		
3	Front door hinge.....	Screwed to front door and front of chest body.		
1	Front end attachment, right.....	Fastened to bottom of chest, front end.		
1	Front end attachment, left.....	.....do.....		
1	Front middle-rail bracket, right.....	Riveted to middle rail and front cross- bar.		
1	Front middle-rail bracket, left.....	.....do.....		
1	Front side-rail bracket, right.....	Riveted to front crossbar and side rail, right.		
1	Front side-rail bracket, left.....	Riveted to front crossbar and side rail, left.		
1	Grindstone fixture.....	Fastened to cover board.....		
1	Grindstone legs clip.....	Fastened in chest.....		
1	Grindstone lid packing.....	Screwed to front lid.....		
1	Hanger bolster.....			
1	Hanger strap, right.....	Bolted to side rail and rear crossbar.....		
1	Hanger strap, left.....	.....do.....		
4	Hanger strap bolt.....			
4	Hasp.....	Two fastened to front door, one to front lid and one to rear lid.		
4	Hasp staple.....	Fastened to chest body.....		
8	Hinge pins.....	Fit into oil-can carrier strap hinges.....		
1	Jackscrew base packing.....	Bolted to cover board.....		
2	Jackscrew handle packing.....	.....do.....		
2	Joint bolt.....	Assemble with body.....		
8	Lid hinge.....	Fastened to lids and chest top.....		
2	Lid prop, left.....	Screwed to lid and chest body.....		
4	Lid prop rivet.....			
4	Lid prop rivet washer.....			
2	Lid prop stop.....	Screwed to chest body.....		
2	Linch pin.....	Fits in axle.....		
2	Linch-pin springs.....	Fastened in linch pin.....		
2	Linch washer.....	On ends of axle.....		
4	Lock attachment staple.....	Screwed to chest body.....		
2	Lock pin.....	Fastened in spare wheel support.....		
1	Lunette.....	Riveted to end of middle rail.....		
1	Lunette prop attachment, front.....	Fastened to rear end of chest body.....		
1	Lunette prop attachment, rear.....	.....do.....		
1	Middle rail.....	Fastened to axle.....		
2	Middle rail bolt.....			
1	Middle rail reinforce, right.....	Riveted to middle rail.....		
1	Middle rail reinforce, left.....	.....do.....		
2	Middle rail separator.....	Fit on middle rail bolt.....		
1	Name plate.....			
	Nuts, steel, special:			
4	0.5-inch.....	For end tie rod.....		
4	0.5-inch.....	For spring assembling bolt.....		
1	0.656-inch ( $\frac{11}{16}$ ).....	For rear bolster bolt.....		
4	0.5-inch hexagonal, 0.875-inch flats.....			
	Nuts, steel, standard:			
6	0.187-inch ( $\frac{3}{16}$ ).....	For carriage bolt.....		
8	0.375-inch.....	For spare wheel fastening bolt.....		
3	0.375-inch.....	For center and front bolts.....		
4	0.5-inch.....	For brake segment bolt.....		
7	0.625-inch.....			

IV

9



## NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Oil can carrier.....	Beneath frame, left and right sides front.	IV	9
	Consisting of:			
4	Oil can carrier brace.....	.....		
4	Oil can carrier bracket.....	.....		
4	Oil can carrier hasp.....	.....		
4	Oil can carrier hinge.....	.....		
4	Oil can carrier slat.....	.....		
4	Oil can carrier strap.....	.....		
2	Oil can lid packing.....	Screwed to front lid.....		
3	Padlock.....	Chained to chest body.....		
1	Partition strap.....	do.....		
2	Pin.....	Driven in spare wheel lock pin.....		
1	Rear bolster bolt.....	.....		
1	Rear cross bar.....	Riveted to side and middle rail.....		
1	Rear end attachment.....	Fastened to bottom rear center of chest body.		
1	Rear middle rail bracket, right.....	Riveted to middle rail and rear cross bar.		
1	Rear middle rail bracket, left.....	do.....		
1	Rear side rail bracket, right.....	Riveted to side rail, right and rear cross bar.		
1	Rear side rail bracket, left.....	Riveted to side rail, left and rear cross bar.		
120	Screws, brass, round-head, 0.75-inch, No. 6.	.....		
1	Side rail, right.....	Seated on axle.....		
1	Side rail, left.....	do.....		
1	Side rail reinforce, right.....	Riveted to side rail, right.....		
1	Side rail reinforce, left.....	Riveted to side rail, left.....		
1	Sleeve.....	Fits on rear bolster, bolt.....		
1	Spare wheel chafe plate, right.....	Screwed and riveted to chest body, right side.		
1	Spare wheel chafe plate, left.....	Screwed and riveted to chest body, left side.		
8	Spare wheel fastening bolt.....	On chest body sides.....		
4	Spare wheel fastening bracket.....	Bolted on chest body sides.....		
4	Spare wheel fastening chain.....	Fastened to chest body sides.....		
4	Spare wheel fastening hinge, male.....	Assembled with spare wheel fastening bracket.		
4	Spare wheel fastening hinge, female.....	do.....		
4	Spare wheel fastening hinge pin.....	do.....		
4	Spare wheel fastening link.....	Assembled with spare wheel fastening bracket.		
8	Spare wheel fastening pin.....	.....		
4	Spare wheel fastening reinforce.....	Bolted on inside of body.....		
2	Spare wheel support.....	Bolted on chest body.....		
8	Spare wheel support bolt, nut, and washer.	On chest body top.....		
2	Spare wheel support cap.....	Assembled with spare wheel support..		
	Split pins:			
4	0.093 inch ( $\frac{1}{8}$ ) by 0.5 inch.....	.....		
4	0.093 inch ( $\frac{1}{8}$ ) by 0.625 inch.....	.....		
2	0.187 inch ( $\frac{3}{16}$ ) by 1.125 inches.....	.....		
8	0.125 inch by 1.25 inches.....	.....		
2	0.312 inch ( $\frac{5}{16}$ ) by 1.5 inches.....	.....		
4	0.375 inch by 4 inches.....	.....		
2	Spring.....	Bolted to brake link and brake arm attachment.		
4	Spring assembling bolt.....	In brake link and brake arm attachment.		
2	Strap fastener.....	Bolted to cover board.....		
1	Turnbuckle stud.....	Riveted on rear board of chest.....		
1	Understrap.....	Bolted to middle rail.....		
2	Understrap bolt.....	.....		
1	Upper tie rod and nut.....	Through chest body.....		
120	Washer, brass.....	For No. 6 wood screw.....		
2	Washer, leather.....	For wheel.....		
2	Washer, steel.....	For brake segment stud.....		
2	Washer, steel.....	For rear bolster bolt.....		
6	Washer, steel.....	For 0.187 inch ( $\frac{3}{16}$ ) carriage bolt.....		
4	Washer, special.....	.....		
2	Washer, steel.....	For 0.312 inch ( $\frac{5}{16}$ inch) D stud.....		
2	Washer, steel.....	For upper tie rod.....		
1	Washer, steel.....	For turnbuckle stud.....		
4	Washer, steel, special.....	For end tie rod.....		
2	Wheels, complete.....	.....		
4	Wing nuts.....	On wing nut pin.....		
4	Wing nut pin.....	Riveted in oil can carrier bracket.....		
4	Wing nut pin washer.....	On wing nut pin.....		
18	Wire staples.....	.....		

## DESCRIPTION OF THE CONVERTED 3-INCH BATTERY WAGON, MODEL OF 1908.

[Plate XXV.]

The principal parts of the battery wagon are the body, axle, road brakes, and wheels.

The body, which is made of wood and bolted to the frame as shown on plate XXV, is provided with interior compartments. Three doors are provided for the body, two on top, at the front and rear ends, and one in front of body. Strengthening braces of wood and steel are provided. Spare wheel supports and spare wheel fastenings are secured to the top and side of the body for transportation of spare wheels. Suitable hinges, hasps, padlocks, etc., are provided for the body. In the compartments are carried the grindstone and can of oil, secured by a permanent packing; and tools, spare parts, and small stores.

The axle, frame, and road brakes are similar in construction to those of the caisson. The wheels are the same as used on the converted limber and caisson.

**3-INCH GUN AND 3.8-INCH HOWITZER, STORE LIMBER, MODEL OF 1902.****WEIGHTS, DIMENSIONS, ETC.**

Weight of store limber, empty	_____pounds	955
Weight of store limber, completely equipped and loaded	_____do	1, 106
Weight of store limber and store wagon, both completely equipped and loaded	_____pounds	4, 008
Diameter of wheels	_____inches	56
Width of track	_____do	60
Free height under limber	_____do	26. 5
Turning angle with store wagon	_____degrees	75

The store limber, model of 1902, is substantially the same as the forge limber, model of 1902 except that the chest is fitted with compartments for carrying the following battery fire-control equipment:

- 10 battery commanders' rulers, wooden.<sup>1</sup>
- 1 battery commander's telescope and mount in case.
- 1 battery commander's telescope tripod in case.
- 5 flash lights with hoods.
- 16 flash lights without hoods.
- 1 steel tape, 100 feet.
- 2 time interval recorders, with chains.

Fire-control equipment furnished by the Signal Corps.

The compartments for telephones, field glasses, battery commander's telescope, and battery case are padded to protect the contents from injury.

**STORE LIMBER, MODEL OF 1902 M<sup>1</sup>.**

The store limber, model of 1902 M<sup>1</sup>, is the same as the store limber, model of 1902, except that it has the identical automatic pole support used on the caisson limber, model of 1916.

<sup>1</sup> Metal B. C. rulers with cases may be retained until supply is exhausted.







## THE STORE WAGON, MODEL OF 1902.

### WEIGHTS, DIMENSIONS, ETC.

Weight of store wagon, empty	-----pounds--	1, 190
Weight of store wagon, completely equipped and loaded	-----do-----	2, 902
Diameter of wheels	-----inches--	56
Width of track	-----do-----	60
Free height under store wagon	-----do-----	26
Turning angle	-----degrees--	75

The store wagon, model of 1902, is the same as the battery wagon, model of 1902, with these exceptions: The vise is omitted, and a frame handle is attached in its place; the store-wagon body forms a single compartment, with two doors on top, the tool-box compartments of the battery-wagon body and the door opening into them being omitted. A crowbar support, front, takes the two left inside rivets for the cross brace, and a crowbar support, rear, is riveted to the chest bottom in front of the axle. A strap fastener with a strap on the left side rail secures the crowbar in the supports. Arrangements similar to those of the battery wagon are made for carrying two spare wheels and three oil cans. The store wagon is intended primarily for carrying such stores, spare parts, and materials as can not be carried in the battery wagon, and, in addition, such stores as may be designated by proper authority.

The battery and store wagons, model of 1902, which are now in service are being modified as they are turned in to an arsenal for repair or alteration. The main modifications are the addition of a foot rest at the front of the chest, transferring the brake system from the rear to the front of the vehicle, and adding handrails, grip and paulin straps to the chest. Axle blocks are added to support the chest under the spare wheels.

## 3-INCH GUN BATTERY AND STORE WAGONS, MODELS OF 1902 Mr.

### WEIGHTS, DIMENSIONS, ETC.

Weight of battery wagon, empty	-----pounds--	1, 444
Weight of battery wagon, completely equipped and loaded	-----do-----	2, 947
Weight of forge limber and battery wagon, both completely equipped and loaded	-----pounds--	4, 524
Weight of store wagon, empty	-----do-----	1, 390
Weight of store wagon, completely equipped and loaded	-----do-----	3, 102
Weight of store limber and store wagon, both completely equipped and loaded	-----pounds--	4, 208
Diameter of wheel	-----inches--	56
Width of track	-----do-----	60
Free height under wagons	-----do-----	24.5
Turning angle with limbers	-----degrees--	75
Weight (approximate) at lunette of both wagons, loaded	-----pounds--	112

## NOMENCLATURE OF PARTS.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
...	1	Arbor-bearing cover.....	In grindstone packing "A".....	IV	9
1	1	Axle.....	At upper ends of transverse braces.....		
2	2	Bearing plate (transverse brake).....	Riveted to brake channel.....		
1	1	Brake-beam guide, right.....	do.....		
1	1	Brake-beam guide, left.....	do.....		
2	2	Brake-beam pin.....	Hinged in brake box.....		
2	2	Brake beam.....	In brake-lever pivot backing.....		
8	8	Brake bolt.....	On bolts.....		
8	8	Brake-bolt nuts.....	Riveted to end of brake channel.....		
2	2	Brake-box filler.....	Fastened to side rail.....		
1	1	Brake channel.....	On brake shaft.....		
2	2	Brake crank.....	Attached to segment.....		
1	1	Brake guard.....	On brake-lever pivot.....		
1	1	Brake lever.....	On brake lever.....		
1	1	Brake-lever catch.....	Riveted on wagon body.....		
1	1	Brake-lever pivot.....	do.....		
1	1	Brake-lever pivot backing.....	Between pivot and box body.....		
1	1	Brake-lever lower filler.....	do.....		
1	1	Brake-pivot side filler.....	Connects brake beam and brace crank.....		
2	2	Brake rod.....	On end of brake rods and connecting rod.....		
4	4	Brake-rod end.....	Inside of brake-spring cover.....		
6	6	Brake-rod pin.....	Upper end bolted to box body.....		
2	2	Brake-rod spring.....	Supports lower end of brake segment.....		
1	1	Brake segment.....	In bearings on axle.....		
1	1	Brake-segment brace.....	On brake shaft.....		
1	1	Brake shaft.....	do.....		
2	2	Brake-shaft bearing.....	On right end of brake shaft.....		
1	1	Brake-shaft bearing, right.....	In brake-shaft bearing.....		
1	1	Brake-shaft crank.....	In brake-shaft bearing, right.....		
2	2	Brake-shaft bushing.....	On outer end of brake beam.....		
2	2	Brake-shaft bushing, right.....	Fasten brake shoe to beam.....		
2	2	Brake shoe.....	Connects brake-spring cover head and end.....		
4	4	Brake-shoe tap bolts.....	Screwed into brake-spring cover.....		
2	2	Brake-spring cover.....	On brake rod and screwed into brake-spring cover.....		
2	2	Brake-spring cover end.....	Riveted to end of brake channel.....		
2	2	Brake-spring cover head.....	do.....		
1	1	Box bottom, left.....	Front of battery-wagon body.....		
1	1	Box bottom, right.....	Attach spare-wheel fastenings.....		
16	16	Box front.....	do.....		
16	16	Cap screw, flat head.....	In chain fastenings.....		
16	16	Screw cap, hex. head.....	Bolted to corner irons, rear.....		
2	2	Chain (door).....	Riveted to door.....		
2	2	Chain fastenings (body), 1 right, 1 left.....	Fastened to side rails.....		
2	2	Chain fastenings (door).....	On cover board, locates chest for spare breech mechanism.....		
4	4	Channel support.....	do.....		
1	1	Cleat, inner.....	Connects brake shaft crank and brake lever.....		
1	1	Cleat, outer.....	do.....		
1	1	Brake rod.....	On box body.....		
1	1	Corner iron, inner (rear), right.....	do.....		
1	1	Corner iron, inner (rear), left.....	do.....		
2	2	Corner iron, inner (front), right.....	do.....		
2	2	Corner iron, inner (front), left.....	do.....		
1	1	Corner iron, outer (rear), right.....	Bolted through box body to corner irons, inner.....		
1	1	Corner iron, outer (rear), left.....	do.....		
2	2	Corner iron, outer (front), right.....	do.....		
2	2	Corner iron, outer (front), left.....	do.....		
1	1	Cover.....	Over top of box body.....		
1	1	Cover board.....	Over partitions.....		
1	1	Cross brace.....	Riveted to side rails.....		
1	1	Cross rail, front.....	Under front of floor body.....		
2	2	Cross rail, intermediate.....	Under middle of floor body.....		
1	1	Cross rail, rear.....	Under rear of floor body.....		
1	1	Crowbar support, front.....	Riveted to left side rail.....		
1	1	Crowbar support, rear.....	Riveted to floor (underneath).....		
4	4	Door boards.....	In door body.....		
3	3	Door hinge plate.....	Attached to floor of battery wagon.....		
1	1	Door hinge, strap, center.....	Riveted to door of battery wagon.....		
1	1	Door hinge, strap, outer, right.....	do.....		
1	1	Door hinge, strap, outer, left.....	do.....		
4	2	End strap.....	On box front of battery wagon and front and tail boards of store wagon.....		



## NOMENCLATURE OF PARTS—Continued.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Floor board, right.....	In floor body.....	IV	9
6	6	Floor board, intermediate.....	do.....		
1	1	Floor board, left.....	do.....		
1	1	Floor cleat, right.....	Screwed to floor.....		
1	1	Floor cleat, left.....	do.....		
1	1	Floor cleat, front, right.....	do.....		
1	1	Floor cleat, front, left.....	do.....		
1	1	Floor cleat, rear, right.....	do.....		
1	1	Floor cleat, rear, left.....	do.....		
3	3	Floor plate.....	1 in cover board at chest for spare breech mechanism; 2 in side boards at packing chest for supplies.		
1	1	Filler block.....	Between brake guard and side board..		
1	1	Filler plate.....	Riveted to right side rail at lock bar...		
1	1	Foot rest.....	On brackets.....		
2	2	Foot-rest bracket, inner.....	Bolted to front of body.....		
1	1	Foot-rest bracket, outer, right.....	do.....		
1	1	Foot-rest bracket, outer, left.....	do.....		
1	1	Foot-rest support, right.....	Tie outer corner of foot rest to end stiffener.....		
1	1	Foot-rest support, left.....	do.....		
1	1	Frame handle, right.....	On front end of side rail.....		
1	1	Frame handle, left.....	do.....		
1	1	Frame reinforced plate.....	do.....		
1	1	Front board.....	Front of store-wagon body.....		
1	1	Front brake brace, right.....	Braces channel to side rail.....		
1	1	Front brake brace, left.....	do.....		
4	4	Grindstone-frame pedestal.....			
1	1	Grindstone-leg bracket, right end.....	Riveted to tailboard.....		
1	1	Grindstone-leg bracket, left end.....	do.....		
1	1	Grindstone lower packing.....	Screwed to cover board.....		
1	1	Grindstone packing "A".....	Bolted to forward lid.....		
1	1	Grindstone packing "B".....	do.....		
1	1	Grindstone packing "C".....	do.....		
1	1	Grindstone packing nut.....	On packing stud.....		
1	1	Grindstone packing stud.....	In lower packing.....		
4	4	Handrail bracket.....	On lid.....		
2	2	Handrail tube.....	On brackets.....		
1	1	Hasp plate (door).....	Riveted to door.....		
2	2	Hasp plate (lid).....	Riveted to lid.....		
2	3	Hasp.....	Assembled to hasp plates.....		
2	2	Hasp rail.....	In lid body.....		
2	3	Hasp staple.....	Riveted to staple plate.....		
2	3	Hasp-staple plate.....	Riveted to front and tail boards.....		
1	1	Hinge board, front.....	Top of box.....		
1	1	Hinge board, rear.....	do.....		
1	1	Hinge board brace, front, right.....	Riveted on underside of hinge board, front.....		
1	1	Hinge board brace, front, left.....	do.....		
1	1	Hinge board brace, rear, right.....	Riveted on underside of hinge board, rear.....		
1	1	Hinge board brace, rear, left.....	do.....		
3	3	Hinge rivet (door).....	In hinge.....		
6	6	Hinge rivet (lid).....	Joins plate and strap.....		
8	8	Hinge rivet (spare wheel fastening bar).....	In hinge.....		
2	2	Hinge rivet (spare wheel support swing bolts).....	do.....		
2	2	Hinge rivet (spare wheel support stud).....	do.....		
1	1	Jackscrew-base packing.....	On cover board.....		
2	2	Jackscrew-handle packing.....	do.....		
10	10	Lid boards.....	In lid body.....		
4	4	Lid brace.....	Riveted on underside of lids.....		
6	6	Lid hinge plate.....	On top rail.....		
6	6	Lid hinge strap.....	On lid.....		
4	4	Lid prop.....	Hinged to lid.....		
4	4	Lid prop pin.....	Screwed into lid hinge straps.....		
2	2	Lid prop plate, right.....	Screwed to sideboard.....		
2	2	Lid prop plate, left.....	do.....		
4	4	Lid prop rivet.....	In lid prop.....		
1	1	Lock chain.....	For locking oil can bar on catch.....		
2	2	Lock-chain ring.....	On lock chain.....		
2	3	Lock-chain staple.....	Riveted to staple plate.....		
2	3	Lock-chain staple plate.....	Screwed to front and tailboards and door of battery wagon.....		
2	2	Lock washer.....	On tie-rod vertical.....		
1	1	Lunette.....	In lunette bracket.....		
1	1	Lunette bracket.....	Front end of side rail.....		

## NOMENCLATURE OF PARTS—Continued.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
2	2	Lunette-bracket filler plate.....	Riveted to bracket.....		
1	1	Lunette nut.....	On lunette.....		
1	1	Middle brace, right.....	Riveted to axle and rail.....		
1	1	Middle brace, left.....	do.....		
1	1	Name plate.....	Riveted on left side rail.....		
16	16	Nut plate.....	Attach spare wheel fastenings.....		
1	1	Oil-can bar.....	Hinged to left side rail.....		
1	1	Oil-can bar catch.....	Riveted to right side rail.....		
1	1	Oil-can bar bracket.....	On oil-can bar.....		
1	1	Oil-can bar buffer.....	do.....		
1	1	Oil-can bar staple.....	In bracket.....		
3	3	Oil-can locking plate.....	On oil-can bar.....		
3	3	Oil-can slats (rectangular).....	On oil-can supports.....		
2	2	Oil-can slats (T shaped).....	do.....		
1	1	Oil-can slat, right (L shaped).....	do.....		
1	1	Oil-can slat, left (L shaped).....	do.....		
6	6	Oil-can support bolt.....	Tie supports to wagon body.....		
1	1	Oil-can support, front.....	Riveted to side rails, rear of axle.....		
1	1	Oil-can support, middle.....	do.....		
1	1	Oil-can support, rear.....	do.....		
3	3	Padlock with 1 bolt snap, 1 chain, and 1 chain ring.....	On chest for lids and for lock bar.....		
....	1	Padlock with 2 chain rings and 1 chain.....	On chest for door.....		
....	1	Partition, front.....	Transversely in box.....		
....	1	Partition, right.....	Longitudinally in box.....		
....	1	Partition, left.....	do.....		
2	2	Prop chain.....	All parts of the prop are pinned or riveted together.		
1	1	Prop-chain button.....			
4	4	Prop-chain ring.....			
2	2	Prop-chain guide.....			
1	1	Prop foot.....			
1	1	Prop eye, right.....			
1	1	Prop eye, left.....			
1	1	Prop fastening pin.....			
1	1	Prop hook.....			
2	2	Prop tube.....			
2	2	Prop chain clamp.....			
8	8	Rail bolts.....	Fasten to side rails.....		
6	6	Rail-bolt brackets.....	Riveted to side rails.....		
1	1	Rear board.....	Rear of box.....		
1	1	Rear-brake brace, right.....	Braces channel to side rail.....		
1	1	Rear-brake brace, left.....	do.....		
1	1	Reinforce (brake segment brace).....	Inside front board (box front).....		
1	1	Segment rack.....	Riveted to brake segment.....		
2	2	Separator.....	Between brake segment and brake guard.....		
....	1	Shot bolt, left.....	At corner of door.....		
....	1	Shot bolt, right.....	do.....		
....	1	Shot-bolt bracket, left.....	Screwed to rear door.....		
....	1	Shot-bolt bracket, right.....	do.....		
....	2	Shot-bolt eye.....	On corner iron rear.....		
....	2	Shot-bolt stop.....	Screwed to rear door.....		
1	1	Side brace, front, left.....	On sideboard.....		
1	1	Side brace, front, right.....	do.....		
1	1	Side brace, rear, left.....	do.....		
1	1	Side brace, rear, right.....	do.....		
1	1	Side-brace front clip.....	At lower end of side brace.....		
1	1	Side-brace rear clip, left.....	do.....		
1	1	Side-brace rear clip, right.....	do.....		
1	1	Side board, left.....	Side of box.....		
1	1	Side board, right.....	do.....		
1	1	Side rail, left.....	Riveted to axle lugs.....		
1	1	Side rail, right.....	do.....		
4	4	Side strap.....	Inside of sideboards.....		
....	3	Slip tongues (door).....	In door boards.....		
7	7	Slip tongues (floor).....	In floor boards.....		
2	2	Slip tongues (hinge board).....	In hinge boards.....		
10	10	Slip tongues (lid).....	In lid boards.....		
2	4	Slip tongues (sideboard).....	In sideboards.....		
4	4	Spare-wheel fastening bar.....	On side braces, front and rear.....		
4	4	Spare-wheel fastening base.....			
4	4	Spare-wheel fastening clip.....			
4	4	Spare-wheel fastening swing bolt.....			
4	4	Spare-wheel fastening stud.....			
4	4	Spare-wheel fastening nut.....			
1	1	Spare-wheel rest.....	Riveted to brake channel.....		
1	1	Spare-pole fastening bolt.....	Fits through spare-pole support, front.....		



## NOMENCLATURE OF PARTS—Continued.

Number on store wagon.	Number on battery wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Spare-pole support, front.....	Riveted to lunette bracket.....	IV	9
1	1	Spare-pole support, rear.....	Riveted to pad on axle.....		
1	1	Spare-pole support cap.....	Bolted to spare-pole support, rear.....		
2	2	Spare-pole support bolt.....	In spare-pole support, rear.....		
2	2	Spare-wheel support.....			
2	2	Spare-wheel support cap.....			
2	2	Spare-wheel support clip.....			
2	2	Spare-wheel support stud.....	On top rail of box.....		
2	2	Spare-wheel support swing bolt.....			
2	2	Spare-wheel support nut.....			
1	1	Strap fastener, crowbar.....	On left-side rail.....		
2	2	Strap fastener, grip.....	On box body.....		
4	4	Strap fastener, jackscrew.....	On cover board.....		
4	4	Strap fastener, paulin.....	On box body.....		
2	2	Stiffener.....	Riveted to front and tail boards.....		
2	2	Supply-chest supports (right and left).....	Screwed on sideboards.....		
1	1	Tailboard.....	Rear of box.....		
1	1	Tie-rod end (front).....	At upper edge of front board.....		
1	1	Tie-rod end (rear).....	At upper edge of tailboard.....		
1	1	Tie-rod, center.....	Horizontal rod through center of box.....		
2	2	Tie-rod, upper.....	Under top-rail.....		
1	1	Tie-rod, vertical.....	Vertical rod through middle of box.....		
1	1	Top rail.....	Top of box.....		
1	1	Transverse brace, left.....	Inside, from middle of floor to spare-wheel supports.....		
1	1	Transverse brace, right.....	do.....		
1	1	Vertical tie-rod washer.....	At transverse braces.....		
1	1	Washer (brake).....	Under head of upper brake segment bolt.....		
1	1	Washer (brake lever).....	On brake-lever pivot.....		
6	6	Washer (oil-can bolt).....	Under heads of oil-can bolts.....		
2	2	Wheels.....	On axle.....		
1	1	Wheel rest.....	On wheel-rest supports.....		
2	2	Wheel-rest support.....	On axle.....		
2	1	Wheel-support strap, front, left.....			
2	1	Wheel-support strap, front, right.....			
1	1	Wheel-support strap, rear, left.....	From spare-wheel supports to wheel-support tie-plates.....		
1	1	Wheel-support strap, rear, right.....			
2	2	Wheel-support tie plate.....	Under axle.....		

In replacements of wooden parts of these wagons it will be necessary to change locations of hasps slightly in certain cases, as well as make necessary fittings, due to the fact that wooden parts warp and shrink in service and in store, and can not be made completely interchangeable.

### 3-INCH GUN AND 3.8-INCH HOWITZER BATTERY WAGON, MODEL OF 1902 MI.

DESCRIPTION OF PARTS WHICH DIFFER FROM THE BATTERY WAGON, MODEL OF 1902.

The chest, with attachments, is much stronger, braced better, and is secured more satisfactorily to the frame.

The weight of the spare wheels is carried directly by the axle instead of at the top of the chest.

The parts of the chest are bolted and screwed together, so that they may be readily disassembled if necessary.

The floor is made of matched poplar boards instead of paneling, and is raised and supported above the frame by means of a channel steel-wheel rest above the axle and two parallel oak cross rails in front and two cross rails in the rear. Angles are riveted to the frame to take the eight rail bolts which secure the chest to the frame.



The ends of the wheel rest project beyond the sides of the body and lie on bronze wheel-rest supports above the axle. Wheel-support straps, front and rear, extend from the spare-wheel supports, and they are bolted to the inside of the body and pass below the axle, to which they are clamped by the wheel-support tie-plates.

Two additional tie-rods are across the center of the chest at the top. The corners of the chest are not dovetailed but reinforced by corner irons, inner and outer. Side straps are bolted through the intermediate cross rails.

The door and lids are made of matched poplar boards except the hasp rail of the lids, which is of oak.

In the forward part of the wagon on the floor are cleats which locate the chest for spare sights and the packing chest for spare parts.

By means of supply-chest supports, which serve as guides on the inside of the sideboards of the wagon, the packing chest for supplies may be drawn to the front as an open drawer when it clears the lid of the wagon and then slid back under the top of the wagon in the closed position. It is held in the latter place by means of barrel bolts locking in two floor plates. A list of contents is on the inside of the supply chest at the rear.

### **3-INCH GUN AND 3.8-INCH HOWITZER STORE WAGON, MODEL OF 1902 M<sub>1</sub>.**

The store wagon, model of 1902 M<sub>1</sub>, is the same as the battery wagon, model of 1902 M<sub>1</sub>, with the exceptions noted under the differences between the store and battery wagons, model of 1902.

#### **CYCLOMETER.**

The store limber of each 3-inch gun battery is fitted with a device which registers the number of miles traveled. This instrument, called a cyclometer, is mounted on the left tie-rod clamp at the rear of the axle and is composed of a star wheel and shaft actuating a train of gears which bring figures representing 0.1 mile to 9,999.9 miles before a glass window in the usual manner of such meters.

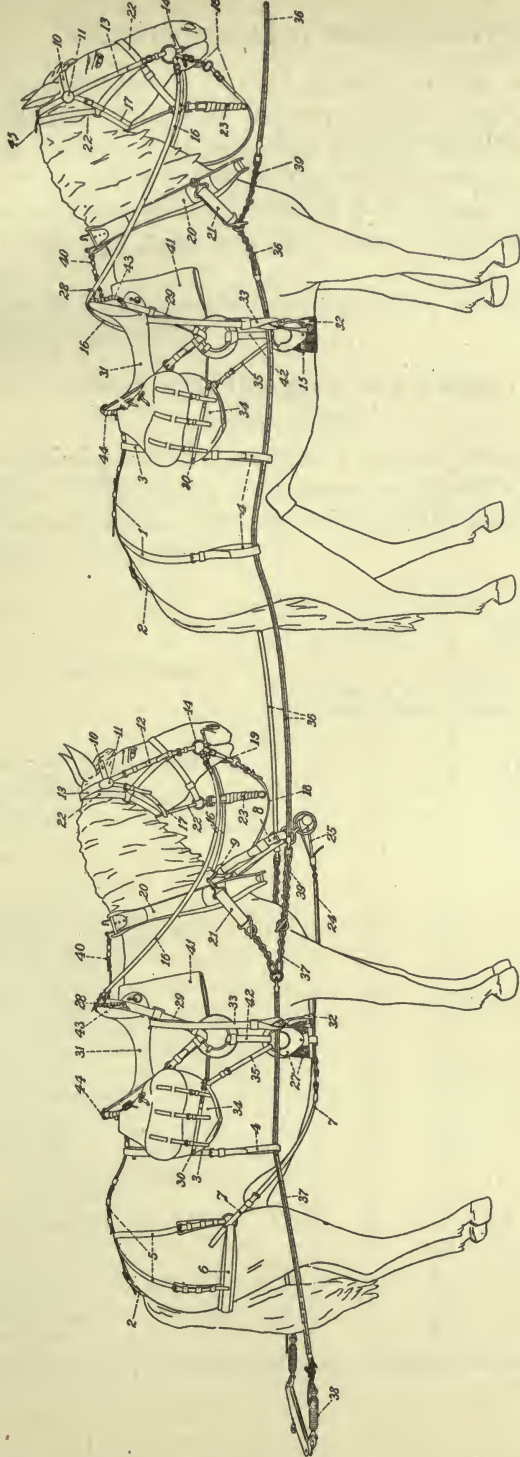
A tally pin riveted to the wheel hub strikes the star wheel and moves it one tooth at each revolution of the wheel.

A special tie-rod clamp is issued with the cyclometer for all batteries.

#### **NOMENCLATURE OF CYCLOMETER PARTS.**

1 bracket (on special tie-rod clamp).  
1 cover.  
1 stop.  
1 spring.  
1 tally shaft.  
1 washer (felt).

1 counter.  
1 case (for counter).  
4 case screws.  
3 bracket screws.  
4 cover bolts with nuts and split pins.  
1 tally pin.



*Off Lead Harness.*  
Showing new model bridle

*Off Wheel Harness*  
Showing old model bridle

Artillery Harness





## PADLOCKS AND BOLT SNAPS.

The padlocks furnished for each separate vehicle, as carriage, forge limber, battery wagon, store limber, or store wagon, excepting the limbers and caissons, will have keys interchangeable for all locks of that particular vehicle but differing from all others.

Limbers and caissons are furnished with a lock, marked "AMMUNITION," which has only one key, these being universally interchangeable.

Bolt snaps for temporarily securing doors, etc., are placed where no shot bolts are provided.

## THE ARTILLERY HARNESS.

[Plate XXVI.]

The component parts of the artillery harness are given in the table below. Plate XVIII shows the harness for the off wheel and off lead horses. The nomenclature corresponding to the numbers on the plate will be found in the table.

No. on Plate XVIII.	Component parts.	Wheel.		Lead.		Property classification.	
		Near horse.	Off horse.	Near horse.	Off horse.	Class.	Sec- tion.
1-4	Backstrap and crupper, complete.....	.....	.....	1	1	IV	8
	Consisting of—						
1	Body and hip straps.....	.....	.....	1	1		
2	Crupper dock.....	.....	.....	1	1		
3	Loin strap.....	.....	.....	1	1		
4	Trace loops.....	.....	.....	4	4		
	Backstrap hook.....	.....	.....	1	1		
	Belly band, complete.....	1	1				
	Consisting of—						
	Belly band.....	1	1				
	Holding down strap.....	2	2				
	Holding down strap hook.....	2	2				
8, 9	Breast strap, complete.....	1	1				
	Consisting of—						
8	Breast strap.....	1	1				
9	Breast-strap hooks.....	2	2				
2-7	Breeching, complete.....	1	1				
	Consisting of—						
5	Backstrap (1) and hip straps (4).....	1	1				
6	Body.....	1	1				
2	Crupper dock.....	1	1				
	Backstrap hook.....	1	1				
	Side strap hooks.....	2	2				
3	Loin strap.....	1	1				
7	Side straps.....	2	2				
4	Trace loops.....	2	2				
10-19	Bridle, complete (old model).....	1	1	1	1		
	Consisting of—						
10	Brow band.....	1	1	1	1		
11	Brow-band ornaments.....	2	2	2	2		
12	Check pieces.....	2	2	2	2		
16	Coupling strap.....	.....	1	.....	1		
19	Connecting strap.....	.....	1	.....	1		
13	Crownpiece.....	.....	1	.....	1		
14	Snaffle bit <sup>1</sup> .....	1	1	1	1		
16	Reins (pairs).....	1	1	1	1		
17	Throatlatch.....	1	1	1	1		

<sup>1</sup> Twenty curb bits with chains are issued for use in place of snaffle bits on fractious draft horses.

No. on Plate XVIII.	Component parts.	Wheel.		Lead.		Property classification.	
		Near horse.	Off horse.	Near horse.	Off horse.	Class.	Sec- tion.
	Bridle, complete (new model), consisting of—						
10	Brow band.....	1	1	1	1		
11	Brow-band ornaments.....	2	2	2	2		
13	Crown piece.....	1	1	1	1		
18	Coupling strap.....		1		1		
14	Snaffle bit <sup>1</sup> .....	1	1	1	1		
16	Reins.....	1	1	1	1		
45	Crown piece strap.....	1	1	1	1		
20	Collar, steel.....	1	1	1	1		
21	Hame tug (a part of the collar).....						
40	Collar strap.....	1	1	1	1		
22, 23	Halter, complete.....	1	1	1	1		
	Consisting of—						
	Crown strap.....	1	1	1	1		
	Cheek piece.....	2	2	2	2		
	Crown chape.....	1	1	1	1		
	Nose band.....	1	1	1	1		
	Chin strap.....	1	1	1	1		
	Throat band.....	1	1	1	1		
	Throat strap.....	1	1	1	1		
	Halter square.....	2	2	2	2		
23	Tie rope.....	1	1	1	1		
21, 25	Martingale, complete.....	1	1				
	Consisting of—						
24	Martingale.....	1	1				
25	Cincha strap.....	1	1				
26-33	Saddle, complete.....	1	1	1	1		
	Consisting of—						
27	Cinchas, with reinforces and loops.....	1	1				
15	Cinchas, without reinforces and loops.....			1	1		
28	Lead-rein roller and strap.....		1		1		
29	Quarter straps, including rings, safes, and cincha straps (side).....	2	2	2	2		
	Quarter strap, cantle.....	1	1	1	1		
	Quarter strap, pommel.....	1	1	1	1		
42	Cincha strap, a part of the saddle quarter strap.....	2	2	2	2		
43	Coat strap, 33-inch (pommel).....	3	2	3	2		
44	Coat strap, 45-inch (cantle).....	1	1	1	1		
30	Coat strap, 60-inch.....				2		
31	Saddletree, leather-covered.....	1	1	1	1		
32	Stirrups (nickel steel).....	2	2	2	2		
33	Stirrup straps.....	2	2	2	2		
34	Saddlebags, pairs.....		1		1		
35	Saddlebag side straps.....		2		2		
36	Traces, lead, model of 1908.....			2	2		
	Consisting of—						
	1 trace body.....						
	1 trace cover.....						
	3 links.....						
	1 chain.....						
	1 toggle.....						
	2 sockets.....						
	2 cones.....						
	2 filler pieces.....						
37	Traces, wheel, model of 1908.....	2	2				
	Consisting of—						
	1 trace body.....						
	1 trace cover.....						
	1 ring.....						
	2 sockets.....						
	2 links.....						
	2 chains.....						
	2 toggles.....						
	2 cones.....						
	2 filler pieces.....						
38	Mogul spring, assembled.....						
	1 loop hook.....						
	1 ring.....						
	1 locking strap.....						
39	Trace chain, body.....			2	2		
	Whip.....	1		1			
	Sweat leathers.....	2		2			
41	Blanket <sup>2</sup> .....	1	1	1	1		

IV

8

<sup>1</sup> Twenty curb bits with chains are issued for use in place of snaffle bits on fractious draft horses.<sup>2</sup> In submitting and in filling requisitions, unless it is specifically stated that saddle blankets are wanted, they will not be included.

## STEEL COLLARS.

## SIZES AND DIRECTION FOR FITTING.

Steel collars are made in the following sizes: 2 A, 2 B, 4 A, 4 B, 5, 5 A, 5 B, 6, 6 A, 6 B, 7, 7 A, 7 B, and 8 A. The number and shape of the collar are stamped on the front side under the extension bolt. The A and B shapes have straighter sides than the numbers without letters. When issued with harness, unless otherwise ordered, 20 per cent of the collars are No. 4 A, 30 per cent No. 5, and 40 per cent No. 5 A, and 10 per cent No. 6. In requisitions, the size of collars desired should be given.

The steel collar pads are made in seven different sizes: No. 0 is 4 inches wide, No. 1 is 4.5 inches, No. 2 is 5 inches, etc., to No. 6, which is 7 inches wide. The pad connections are also furnished in seven sizes, from No. 0 to No. 6. For the plain number of collar (5, 6, or 7) the regular adjustment requires a pad connection of the same number as the pad. The A and B shapes have straighter sides and take a pad connection two sizes larger than the pad—that is, it would take a No. 3 connection with a No. 1 pad, etc., for the regular adjustment in these shapes. When the collar is very wide at the top and narrow at the bottom the size of the pad connection must be increased one or two numbers to allow the collar to close easily at the bottom. In the reverse case, a smaller pad connection should be used. The collar pads are numbered on the front inner side. The pad connections are numbered on the side having the round holes, which side must be kept to the front on the collar. *In requisitions for collar pads and pad connections the sizes desired must be stated.*

The buckle is made in two sizes. No. 2 is 1 inch longer than No. 1, and is used with the larger sizes of collar pad.

The correct adjustment and fitting of collars is of the utmost importance. The variety of sizes and shapes of collars, pads, pad connections, and buckles issued by the Ordnance Department is sufficient to enable any horse to be correctly fitted. Efficient supervision by officers of the fitting of collars and of the adjustment of the point of draft (trace plate) is required to secure proper results.



Table of dimensions.

## SIZE OF COLLARS FITTED WITH NO. 3 PADS.

Number of collar.	Length of collar inside.	Width 6 inches down from top.	Width 8 inches down from top.	Width at draft.	Number of collar.	Length of collar inside.	Width 6 inches down from top.	Width 8 inches down from top.	Width at draft.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
2 A.....	18	6 $\frac{3}{4}$	7 $\frac{1}{4}$	8 $\frac{3}{4}$	6.....	22 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{3}{4}$	9 $\frac{3}{4}$
2 B.....	18	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8	6 A.....	22 $\frac{1}{2}$	7	7 $\frac{3}{4}$	9 $\frac{1}{2}$
4 A.....	19 $\frac{1}{2}$	7	7 $\frac{1}{2}$	8 $\frac{3}{4}$	6 B.....	22 $\frac{1}{2}$	7	7 $\frac{3}{4}$	9 $\frac{1}{2}$
4 B.....	19 $\frac{1}{2}$	6 $\frac{3}{4}$	7 $\frac{1}{2}$	8 $\frac{3}{4}$	7.....	24	7 $\frac{3}{4}$	8 $\frac{3}{4}$	10 $\frac{1}{2}$
5.....	21	7 $\frac{3}{4}$	8 $\frac{3}{4}$	9 $\frac{1}{2}$	7 A.....	24	7	7 $\frac{3}{4}$	9 $\frac{1}{2}$
5 A.....	21	7	7 $\frac{1}{2}$	9	7 B.....	24	7	7 $\frac{3}{4}$	10
5 B.....	21	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$	8 A.....	25 $\frac{1}{2}$	7	7 $\frac{3}{4}$	9 $\frac{3}{4}$

## SIZE OF COLLARS FITTED WITH NO. 1 PADS.

2 A.....	16 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{7}{8}$	7	6.....	21	6 $\frac{3}{8}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$
2 B.....	16 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	6 A.....	21	6	6 $\frac{1}{2}$	8 $\frac{1}{2}$
4 A.....	18	5 $\frac{1}{4}$	6 $\frac{1}{4}$	7 $\frac{1}{2}$	6 B.....	21	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$
4 B.....	18	5 $\frac{1}{8}$	5 $\frac{5}{8}$	7 $\frac{1}{8}$	7.....	22 $\frac{1}{2}$	6 $\frac{3}{8}$	7 $\frac{3}{8}$	8 $\frac{3}{8}$
5.....	19 $\frac{1}{2}$	6 $\frac{1}{4}$	7 $\frac{1}{4}$	8 $\frac{1}{4}$	7 A.....	22 $\frac{1}{2}$	5 $\frac{3}{4}$	6 $\frac{3}{4}$	8 $\frac{1}{4}$
5 A.....	19 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	7 B.....	22 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$
5 B.....	19 $\frac{1}{2}$	5 $\frac{1}{8}$	5 $\frac{3}{8}$	7 $\frac{1}{4}$	8 A.....	24	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$

The table of dimensions gives the largest and smallest size that each collar can be made with the No. 3 and No. 1 pads. Adding one-half inch in length and width to the smallest dimensions given in the table will give the size of the collars when fitted with the No. 2 pads. These examples are given to show the three regular adjustments in each size of collar, but these dimensions can be varied to suit the different shapes of necks. The largest pad can be put in the top of the collar and the bottom taken in to its smallest dimensions, or the smallest pad can be put in the top and the bottom left out. While each collar can be lengthened or shortened and taken in or let out at the bottom by means of the adjustments provided, the width at the top can not be changed without using a larger or smaller pad.

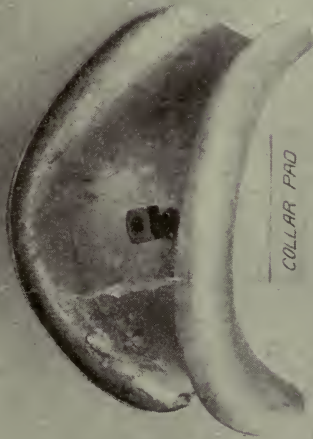
In fitting irregular shapes none of the connections may give just the proper tension on the pad. In such a case use the one that comes nearest and straighten or bend the extension at the top. When the collar is required to be widened at top to relieve the pressure on the pad and make it lock easily at the bottom, open the collar wide and place a round piece of hard wood or iron, 1 inch in diameter and 2 inches long, between the connection and collar side close up to the hinge; then press the sides together and bend both sides alike, so that they will be the same length at the bottom. Do not let the fulcrum rest on the pad, for it will bend it. If the collar sides require straightening to close them tighter on the pad and give more tension on the latch at the bottom, open the collar at the bottom, hook the wrench over the top of collar side, and press down the lever, treating both sides alike.



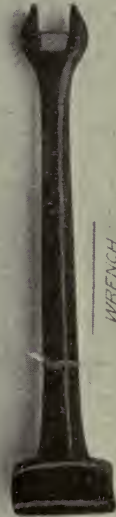
COLLAR STRAP



COLLAR PAD CONNECTION



COLLAR PAD



WRENCH



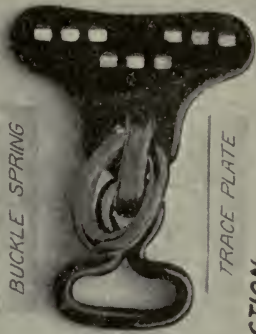
BUCKLE LATCH



DRAFT SPRING



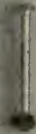
PAD HOOK



TRACE PLATE



BOLT AND NUT FOR TOP CONNECTION



BOLT AND NUT FOR BOTTOM OF COLLAR



PAD BOLT AND NUT



BOLT AND NUT FOR TRACE PLATE

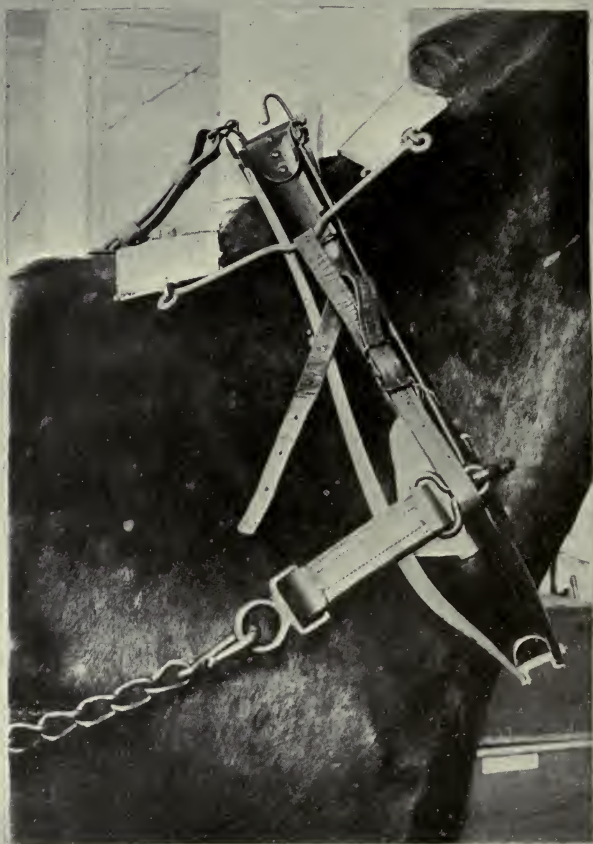


BOLT AND NUT FOR EXTENSION



BUCKLE SPRING

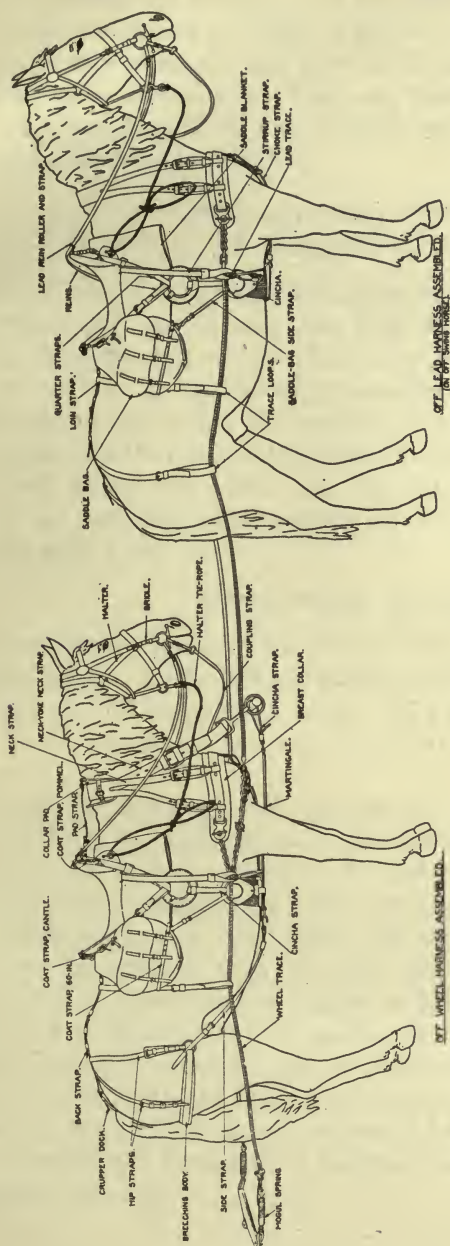
COLLAR BACK STRAP CONNECTION



*Collar Lifting Device.*



PLATE XXIX



BREAST COLLAR HARNESS



Both of these operations can be performed with the collar put together.

Parts furnished for the repair of the collars with the correct names of the parts are shown on Plate XXVII.

Canvas collar pads are not part of the artillery harness, but are furnished upon requisition. They are made in sizes Nos. 2, 3, 4, 5, and 6, as called for; if no size is called for, they are made in equal proportions of Nos. 4, 5, and 6.

#### COLLAR-LIFTING DEVICE.

[Plate XXVIII.]

This is a simple device for lifting the steel collar from the horse's neck, when, for any reason, the neck becomes sore. The straps securing it to the hame tugs afford easy attachments to or removal from the collar. By supporting the collar by canvas pads in front and in rear of the collar, the pressure is removed from the surface of the neck directly beneath the collar, and the weight is more evenly distributed along the neck. In case of necessity, such a device, made by the organization mechanic, will allow working a horse when suffering with a sore neck.

#### BREAST COLLAR HARNESS.

The component parts of the Breast Collar Harness are given in the table below. Plate XXIX shows the harness for the off wheel horse and the off lead swing horse. The nomenclature as given in the table is also given and the particular parts designated on the plate.

The essential difference between the two harness sets as shown on Plates XXVI and XXIX is in the harness used upon the neck, shoulders, and breast. Instead of a steel collar clasped about the neck and held in place by a collar strap and hame tugs, a leather strap stretching across the breast and supported by a strap running over the neck is used with the Breast Collar Harness. At either end the breast collar is toggled to the trace; in front it is held down by a chokestrap which passes between the forelegs and is buckled around the cincha. On the wheel horse, the neck strap and neck-yoke neck strap are held in a collar pad which is hooked to the pommel by the pad strap and pad-strap hook. The neck-yoke neck strap encircles the neck and is fastened to the yoke pole.



## COMPONENT PARTS.

	Wheel.		Lead.		Property classification.	
	Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
Backstrap and crupper, complete			1	1		
Consists of:						
Body			1	1		
Hip strap			2	2		
Crupper dock			1	1		
Loin strap			1	1		
Trace loops			4	4		
Backstrap hook			1	1		
Breast collar, complete, consists of:						
Breast collar	1	1	1	1		
Chokestrap	1	1	1	1		
Neck strap	1	1	1	1		
Collar pad, assembled	1	1				
Body						
Buckle chapes						
Pad strap with hook						
Neck-yoke neck strap	1	1				
Breeching, complete, consists of:						
Body	1	1				
Backstrap	1	1				
Hip straps	4	4				
Backstrap hook	1	1				
Crupper dock	1	1				
Side straps	2	2				
Side-strap hooks	2	2				
Trace loops	2	2				
Loin strap	1	1				
Bridle, complete (model of 1913), consists of:						
Brow band	1	1	1	1		
Brow-band ornaments	2	2	2	2		
Crownpiece	1	1	1	1		
Crownpiece strap	1	1	1	1		
Coupling strap		1		1		
Reins	1	1	1	1		
Snaffle bit <sup>1</sup>	1	1	1	1		
Halter, complete, consists of:					IV	8
Crown strap	1	1	1	1		
Cheek piece	2	2	2	2		
Crown chape	1	1	1	1		
Nose band	1	1	1	1		
Chin strap	1	1	1	1		
Throat band	1	1	1	1		
Throat strap	1	1	1	1		
Halter square	2	2	2	2		
Tie rope	1	1	1	1		
Martingale, complete, consists of:						
Martingale	1	1				
Cincha strap	1	1				
Saddle, complete, consists of:						
Cinchas, with reinforces and loops	1	1				
Cinchas, without reinforces and loops			1	1		
Lead rein roller and strap		1		1		
Quarter straps, side, including rings and safes	2	2	2	2		
Quarter strap, pommel	1	1	1	1		
Quarter strap, cantle	1	1	1	1		
Cincha strap	2	2	2	2		
Coat strap, 33 inch (pommel)	3	2	3	2		
Coat strap, 45-inch (cantle)	1	1	1	1		
Coat strap, 60-inch		2		2		
Saddletree leather covered	1	1	1	1		
Stirrups, model of 1912	2	2	2	2		
Stirrup straps	2	2	2	2		
Saddlebags, pairs		1		1		
Saddlebags, side straps		2		2		
Traces, lead, model of 1908			2	2		
Consists of:						
1 trace body						
1 trace cover						
3 links						
1 chain						
1 toggle						
2 sockets						
2 cones						
2 filler pieces						

<sup>1</sup> Twenty curb bits and chains per battery are issued for use in place of snaffle bits with fractious horses.

## COMPONENT PARTS—Continued.

	Wheel.		Lead.		Property classification.	
	Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
Traces, wheel, model of 1908. ....	2	2			IV	8
Consists of:						
1 trace body .....						
1 trace cover .....						
1 ring .....						
2 sockets .....						
2 links .....						
2 chains .....						
2 toggles .....						
2 cones .....						
2 filler pieces .....						
Mogul spring, assembled. ....						
1 loop hook .....						
1 ring .....						
1 locking strap .....						
Trace chain body .....			2	2		
Whip .....	1		1			
Sweat leathers .....	2		2			
Blanket <sup>1</sup> .....	1	1	1	1		

<sup>1</sup> In submitting and in filling requisitions, unless it is specifically stated that saddle blankets are wanted, they will not be included.

## THE CARE AND PRESERVATION OF LEATHER.

Attention is invited to the following:

“It is forbidden to use any dressing or polishing material on the leather accouterments or equipments of the soldier, the horse equipments for cavalry, or the artillery harness except the preparations supplied by the Ordnance Department for that purpose.” (A. R. 293 of 1913.)

## REASON FOR OILING LEATHER.

Leather, as it comes from the tannery in manufacture, is hard, rough, brittle, inflexible, and readily absorbs water. To remove these undesirable qualities and render the leather soft, pliable, flexible, and impervious to water, to increase the strength and toughness of the fiber, and to give the leather such a surface color and finish as will make it most sightly and suitable for the purpose for which intended, the manufacture is continued by hand stuffing it with a dubbing made of pure cod-liver oil and tallow, which the experience of curriers has shown to be the best material for this purpose. This dubbing is thoroughly absorbed by the leather, penetrating it completely, and is not merely limited to the surface.

The russet leather now used by the Ordnance Department in the manufacture of all leather equipments is pure oak tanned, of No. 1 tannage and finish, hand stuffed with a light dubbing made of pure cod-liver oil and tallow to preserve the leather, the dubbing being so sparingly used that the oil will not exude. This leather as it comes from the manufacturer contains enough oil to materially improve its

quality and prolong its life, but not enough to soil the clothing if the equipment is properly cared for. No oil whatever is added to the leather in the manufacture of the equipments at the Government arsenals.

#### CARE OF RUSSET LEATHER.

Leather equipments which have become wet should be dried in the shade. Wet leather exposed to the direct rays of the sun or to the heat of a stove or radiator becomes hard and brittle.

When russet-leather equipments become soiled in service they should be cleaned by carefully washing the leather with a sponge moistened with a heavy lather made of clean water and Castile or Frank Miller's soap, and then rubbing vigorously with a dry cloth until the leather is completely dry.

If the leather becomes harsh, dry, and brittle from exposure to water or other causes, clean as above described, and while the leather is still slightly moist apply an exceedingly light coat of neat's-foot oil by rubbing with a soft cloth moistened (not *saturated*) with the oil. If it is found that too much oil has been used, the surplus can be readily removed by rubbing with a sponge moistened with naphtha or gasoline. But these oils are not issued for this purpose.

Where a polish is desired, the leather should first be thoroughly cleaned and then the leather polish or dressing supplied by the Ordnance Department should be applied sparingly and thoroughly rubbed in with a soft, dry cloth. Scars, cuts, or abrasions of the leather may be improved in appearance but not obliterated by similar use of the leather polish.

Russet leather may be cleaned, oiled, and polished as described above, but it should be noted that if more than a light coat of oil be given the leather will be greatly darkened and will quickly soil the clothing. No method of cleaning will restore the original light color of the leather or remove stains or discolorations.

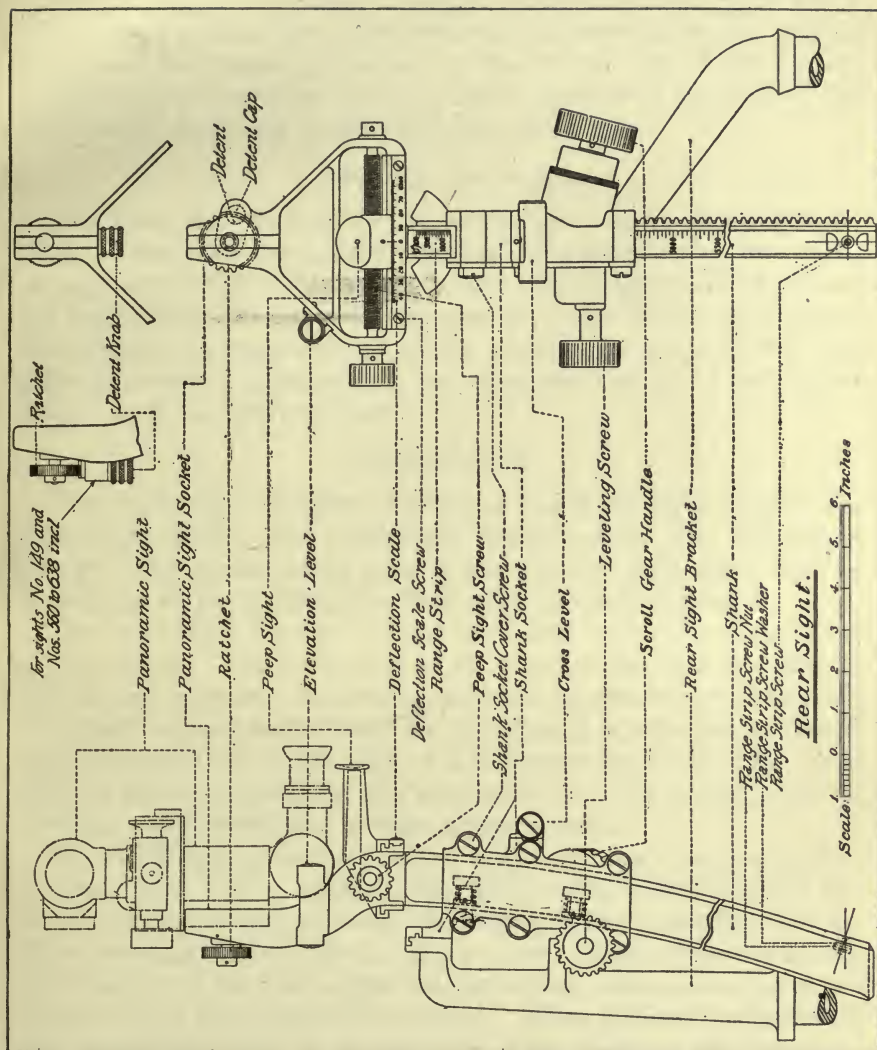
#### CARE OF BLACK LEATHER.

To clean and dress black leather, wash it in water (lukewarm preferred) with castile soap. An old horse brush will be found very satisfactory for applying the soap and water. Dry in the shade; when almost dry, apply the blacking, rubbing it in thoroughly.

Dry in the shade and then apply neat's-foot oil with a sponge or rag, rubbing in well until the leather is soft and pliable.

When dry, a certain amount of oil and blacking will exude from the leather; this should be rubbed off with a dry cloth.







## SIGHTS.

The instruments provided for sighting and laying the piece include a line sight, a rear sight, a front sight, a panoramic sight, and a range quadrant.

## LINE SIGHT.

The line sight consists of a conical point as a front sight and a V notch as a rear sight; the former is screwed into the locking hoop, and the latter is attached to the breech end of the jacket; together they determine a line of sight parallel to the axis of the bore, useful in giving general direction to the gun.

## FRONT AND REAR SIGHTS.

The front and rear sights are for general use in direct aiming. They consist of a front sight carrying cross wires and a rear sight of the peep variety. The length of the line of sight is 36.75 inches; its height from the ground with gun at  $0^\circ$  elevation is 44.9 inches. The sights are supported from the cradle; the peep of the rear sight is in such a position as to come opposite the eye of the gunner seated upon the left trail seat.

## THE FRONT SIGHT.

The front sight complete consists of the front sight proper, the front-sight holder, the front-sight bracket sleeve, the front-sight bracket with spring catch riveted on, and two split pins; that is, it includes all parts except the front-sight bracket support.

The front-sight bracket support is riveted to the cradle in front of the shield. The lower end of the bracket fits into a socket in the bracket support. In sighting position the bracket projects from the cradle toward the left, but for traveling it is arranged so that it may be swung out of the way of a cannoneer upon the seat. It is held in either position by the engagement of the spring catch in notches in the front-sight bracket support socket.

The front sight proper consists of a pair of cross wires mounted in a ring. This ring is secured, with cross wires at an angle of  $45^\circ$  to the horizontal, in the circular hole through the front-sight holder. The front-sight holder has the shape of an eyebolt; its shank screws into the top of the front-sight bracket sleeve, which screws over the upper end of the front-sight bracket. When adjusted, rotation of the front-sight holder in the sleeve or of the sleeve on the front-side bracket is prevented by split pins.

## THE REAR SIGHT.

[Plate XXX.]

The rear sight includes all parts except the rear-sight bracket support and the panoramic sight. The rear-sight bracket support



is riveted to the cradle and has a socket into which the lower end of the bracket is secured by a nut, lock nut, and split pin. The upper end of the rear sight bracket is provided with circular guides cut with the line of sight, gun at  $0^\circ$  elevation, as an axis, and upon these guides a shank socket for the shank or stem of the sight is mounted. In a support forming part of the shank socket is a leveling screw with threads engaging the segment of a worm wheel cut upon the rear-sight bracket guides. A spirit level is mounted upon the shank socket. This arrangement enables correction to be made for difference of level of wheels, since turning the leveling screw revolves the shank socket and with it the shank about an axis parallel to the axis of the bore. A shank-socket cover is provided to strengthen the shank socket. The latest type of shank socket is made of bronze and the leveling-screw support is made integral with it. The sight-shank cover has two lugs on its inner surface which support springs and sleeves. These sleeves are pressed by the springs against the shank and force it against the walls of the shank socket, thus taking up lost motion.

The shank consists of a steel arc whose center is the front sight; it slides in guides in the shank socket and is moved up and down in elevation by a scroll gear seated in a boss upon the shank socket and engaging in a rack cut upon the right face of the shank. A German-silver range strip fits in a dovetail seat cut in the rear face of the shank, the index for the scale being placed upon the upper rear corner of the shank socket. The range strip is graduated in yards up to 6,500; the smallest division is 50 yards, but smaller subdivisions may readily be made with the eye. The scroll gear is held in mesh with the rack on the shank by the scroll-gear spring. Large movements of the shank may be quickly made by pulling the scroll-gear handle out far enough to disengage the scroll gear from the rack and then sliding the shank through the shank socket by hand.

To the left side of the shank is riveted the elevation-lever holder, and in this holder is mounted a spirit level with axis parallel to the line joining the peep and front sights. This level enables quadrant elevations to be given by setting the sight at the desired range and moving the gun in elevation until the level bubble is brought to the center, provided the target and gun were on the same level; i. e., angle of sight = 300.

The shank is fashioned into a deflection guide and mounting for the peep sight and is prolonged upward to form a support for the panoramic sight. The peep-sight guide is located in a transverse opening in the shank and is perpendicular to the shank and to the line of sight. The peep sight is clipped to this guide and is traversed along it by the peep-sight screw. The latter passes through a tapped





## Panoramic Sight.

Model of 1904.



hole in the peep sight and is supported at each end in bearings in the shank. The screw is turned by a knurled head at its left end.

The deflection scale is attached to the rear face of the peep-sight guide and the index for the deflection scale is on the peep sight. The graduations are in mils. There are 45 mils upon each side of the zero, and the scale is marked from left to right as follows:

40    30    20    10    0    90    80    70    60

the actual mils being—

40    30    20    10    0    6,390    6,380    6,370    6,360

thus making deflection readings on this sight uniform with those of the panoramic sight and the battery commander's telescope. The scale allows for longitudinal adjustment.

The seat for the panoramic sight is a vertical T slot into which the shank lug of the panoramic sight fits. The panoramic sight is held in place and all wear of the parts is taken up by a clamp screw, ratchet, and detent.

In firing, the sight is left in its seat.

#### THE PANORAMIC SIGHT, MODEL OF 1904.

[Plate XXXI.]

The panoramic sight is a vertical telescope so fitted with reflecting prisms that the gunner with his eye at the eyepiece, which is fixed in a horizontal position, may bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The details of the optical part of this instrument are shown in Plate XXXI, and comprise the rotating head prism A, the rotating prism B, the objective lens C, the lower reflecting prism D, and the eyepiece E. The rays coming from the object are reflected downward from the prism A into prism B, which rectifies them; after their passage through the objective lens C the prism D reflects them in such a way that there is presented to the eyepiece E a rectified image, which the eyepiece magnifies. The prism B is of rectangular cross section. Its peculiarity is that on rotation about its longitudinal axis the image of an object seen through it turns with twice the angular velocity of the prism. As, therefore, the prisms A and B are so mounted as to rotate about this axis, prism B following A with one-half the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary terrestrial telescope.

The image formed by the objective lens would naturally be reversed and inverted. The lower inclined faces of the prism D by

cross reflection transfer the rays to opposite sides of the axis, thus correcting the reversal. The correction of the inversion is accomplished by the combined action of the three prisms A, B, and D, the nature of the action varying with the different positions of the prisms. In the position shown on Plate XXXI, prisms A and D act as parallel reflectors, and they without the lens system would present an erect image. Prism B, however, inverts the rays and corrects the inversion produced by the objective lens. It will be noted the effect would be the same whether the prism B occupies the position shown on the plate or be revolved  $180^\circ$  from that position. This latter position is the one it would assume if the prism A were rotated through  $360^\circ$ . If the prism A be now rotated through  $180^\circ$  the prisms A and D would form two reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. Prism B in this case will occupy a position  $90^\circ$  from that shown on the plate, in which position it causes no inversion, but counteracts the inversion produced by prism D.

A glass reticule marked with cross lines is located in the focal plane of the instrument, with the intersection of the cross lines coincident with its optical axis. No provision is made for changing the focus of eyepiece or objective lens. As issued, the instrument is focused for the usual range and the average eye. The magnifying power of the instrument is four; the field of view is  $10^\circ$ .

The mechanical construction of the instrument is as follows: The body consists of a shank, provided on its front surface with a T lug which fits into a corresponding slot in the head of the shank of the rear sights and is held in that position by a clamp screw, which is locked by a detent and ratchet, thus firmly securing the instrument in place. To the lower end of the shank is screwed the eyepiece elbow, forming a housing for the prism D and the eyepiece E. The latter projects to the rear just above the peep sight of the rear sight. To the upper end of the shank is screwed the azimuth-circle support, to which is screwed the hood for the azimuth circle, forming a seat for the rotating mechanism of the sight. The opening in the rotating head is closed by the rotating head window, which forms a dust guard. The rotating head prism A is mounted opposite this opening. The lower end of the rotating head is seated in the azimuth circle hub and gear. A worm located in bearings in the hood for azimuth circle engages in a worm rack cut on the azimuth circle. The rotating prism B is secured in the upper end, and the objective C in the lower end, of the supporting sleeve for rotating prism resting in the azimuth circle hub and gear. The upper end of the supporting sleeve for the rotating prism and the lower end of the azimuth circle hub and gear have gears which engage in a double pinion seated in the



azimuth-circle support. The gears and pinions are calculated so that the angular velocity of the rotating head is twice that of the rotating prism B and is in the same direction. The motion of rotation is transmitted from the worm to the azimuth circle, thence to the azimuth-circle hub and gear, thence to the pinion, and through it to the supporting sleeve for rotating prism. The amount of motion of the rotating head prism is indicated by a graduated scale on the perimeter of the azimuth circle, visible through the glass azimuth-circle window in the rear face of the hood for the azimuth circle. The zero of the scale and the movable index cover on the hood for azimuth circle are located so that the line of sight of the panoramic sight is parallel to that of the rear sight, and consequently to the axis of the gun, when both sights are set at 0 elevation and deflection.

The scale is formed by dividing the circumference into 64 equal parts. One complete turn of the worm moves the rotating head prism through one of these divisions, or  $\frac{1}{64}$  of a circle. The rear end of the worm carries the worm index with circumference graduated into 100 equal parts to form a micrometer scale. One of these subdivisions, therefore, equals  $\frac{1}{100}$  of a division of the main scale, or marks a movement of the rotating head prism and line of sight through  $\frac{1}{6400}$  of a circle. An angular movement of the line of sight through  $\frac{1}{6400}$  of a circle corresponds very closely to a lateral displacement of  $\frac{1}{1000}$  of the range. Practically, the subdivisions of the deflection scale on the panoramic sight are considered as points equal to  $\frac{1}{1000}$  of the range and are called millièmes or mils.

The reading of the deflection scale or the size of an angle is given in the units of the worm index as 2763, 1521, etc., meaning  $\frac{2763}{6400}$ ,  $\frac{1521}{6400}$ , etc., of  $360^\circ$ . The alternate divisions of the main scale are numbered in a clockwise direction 0, 2, 4, etc., to 62, inclusive. In reading the deflection scale, therefore, hundreds are read directly from the main scales and tens and units from the worm index. At 0 the line of sight is parallel to the vertical plane through the axis of the gun; at 16 (or 1,600 mils) it is perpendicular to that plane and pointing directly to the right, etc.

The worm index forming the micrometer scale is secured on a coned seat on the end of the worm by a nut and is held against rotation on its seat by friction. This arrangement permits the 0 of the worm index to be set opposite the index mark on the casing without movement of the worm in adjusting the sight.

The worm is held in contact with the worm gear on the azimuth circle by a spring and is arranged so that it may be disengaged from the worm gear by movement of a worm-box eccentric lever. When disengaged, the line of sight may be rapidly oriented to approximately the desired direction, the worm then thrown into gear, and finer adjustments made by turning the worm knob.



All panoramic sights have been made interchangeable, so as to fit in seats.

The following device for illumination of the crosslines of the reticule of panoramic sights is used.

A small slit is cut in the eyepiece elbow and the reticule cell on the side of the sight next the gun. A shutter is provided which encircles the eyepiece elbow opposite the slit, affording means for closing. On some sights this shutter is provided with a transparent celluloid window to prevent the entrance of dust. On the later sights a glass window is fitted in the side of the eyepiece.

For illumination at night electric flash lights are used. They should be held close to the illuminating slot or window.

#### PANORAMIC SIGHT, MODEL OF 1915.

[Plate XXXII.]

The panoramic sight is a vertical telescope so fitted with an optical system of reflecting prisms and lenses that the gunner with his eye at the fixed eyepiece in a horizontal position can bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The rays coming from the object are reflected downward from the rotating head prism into the rotating prism. The rotating prism rectifies the rays; after their passage through the achromatic objective lens, the lower reflecting prism reflects them in such a way that there is presented to the eyepiece a rectified image, which the eyepiece magnifies. The peculiarity of the rotating prism is that upon rotation about its longitudinal axis the image of the object seen through it turns with twice the angular velocity of the rotating prism. The rotating head prism and rotating prism are so mounted as to rotate about this axis, the rotating prism following rotating head prism with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary telescope. The image formed by the achromatic objective lens would then be reversed and inverted. The rays are cross reflected to the opposite sides of the axis by the inclined faces of the lower reflecting prism, thus correcting the reversal.

The combined action of the rotating head prism, the rotating prism and lower reflecting prism and the nature of action varying with different positions of the prisms provide for the correction of the inversion of the image. The rotating head prism and lower reflecting prism as shown in position on Plate XXXII act as parallel reflectors and they without the lens system would present an erect image. The rotating prism, however, inverts the rays and corrects the inversion produced by the achromatic objective lens. It will be noted that the







effect would be the same whether the rotating prism occupies the same position shown on the plate or be revolved  $180^\circ$  from that position.

The rotating head prism must be turned through  $360^\circ$  to get a position of  $180^\circ$  for the rotating prism. If the rotating head prism is rotated through  $180^\circ$ , the rotating prism and lower reflecting prism would form reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. The rotating prism in this case will occupy a position  $90^\circ$  from that shown on the plate, in which position it causes no inversion but counteracts the inversion produced by the lower reflecting prism.

The instrument has a magnifying power of 4 and a field of view of  $10^\circ$ .

The principal parts of the panoramic sight are the rotating head mechanism, the elevation device, the azimuth mechanism, the rotating prism mechanism, the deflection mechanism, the shank and the eyepiece.

The rotating head mechanism consists principally of the rotating head, rotating head prism, rotating head prism holder, prism holder cover, elevation index support, prism shield, and rotating head cover.

The rotating head forms a housing for its movable parts, and provides seats for the elevation-worm bushing and rotating head prism holder. The front opening of the rotating head is closed by the prism shield which forms a dust guard. The bottom threaded seat of the rotating head screws upon the upper end of the azimuth worm wheel and is locked in place by four azimuth scale retaining ring screws. Upon the rear face of the rotating head is engraved a scale which is used for measuring the elevation of the rotating head prism holder which retains the rotating head prism and has an index mark upon the projection which coincides with the graduations of the elevation worm micrometer head.

The rotating head prism is mounted within the rotating head prism holder between the prism support front, prism support bottom, and prism support back, and secured in position by the rotating head prism spring which bears upon the prism support back. The rotating head prism is protected on the right side by the prism holder cover and on the left side by the elevation index support. The movement of the rotating head prism holder is limited by the stop screw which slides in an elongated slot in the rotating head prism holder.

The prism shield is held within the rotating head by the prism shield retaining piece, which is in turn secured by two prism shield retaining piece screws.

The prism-holder cover screws into its threaded seat located in the right side of the rotating head prism holder and locked in position by the prism-holder cover screws.

The rotating head cover screws into its threaded seat located in the right side of the rotating head and held in place by the rotating head cover screws. The exterior of the rotating head cover has two small holes for teat wrench, and engravings "Field 10°" and "Power 4" are located on the exterior surface.

The elevation-index support screws into its threaded seat located in the left side of the rotating head prism holder and secured in place by the elevation-index support screw. The small holes in the exterior surface allows the use of teat wrench to enable the elevation-index support to be screwed in place. The support retaining ring retains the elevation-index support with rotating head prism holder within the rotating head and is locked in position by the support-retaining ring screw.

The elevation index is held upon the elevation-index support by the two elevation-index retaining screws. The arrow, engraved upon the German silver piece which is dovetailed in the elevation index, coincides with the graduations of the scale engraved upon the rear face of the rotating head.

The elevation device consists principally of the elevation segment, elevation worm, elevation-worm bushing, elevation-worm retaining nut, and elevation-worm micrometer head.

The elevation segment is held in its seat, provided in the rotating head prism holder, by the segment lock pin.

The elevation worm is mounted eccentrically within the elevation-worm bushing, which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the elevation segment.

The elevation-worm bushing has a screw-driver slot in its lower end which is used for adjusting and is retained in position by the elevation-worm bushing clamp plug, which is secured by the bushing clamp-plug screw.

The elevation-worm retaining nut retains the elevation-worm bushing and elevation worm lengthwise within the rotating head. The screw-driver slot, in the top of the elevation-worm retaining nut, is used for adjusting and is locked in position by the elevation-worm retaining nut screw.

The elevation-worm micrometer head is held upon the upper slotted end of the elevation worm by the locking screw. The scale, engraved upon the periphery, is graduated into 100 equal divisions, numbered every 10 divisions. The upper exterior diameter of the elevation-worm micrometer head is straight knurled to facilitate turning. One complete revolution of the elevation-worm micrometer head is equal to the distance between each graduation upon the scale on the rear face of the rotating head.



The open sight is constructed of bronze plate bent to shape having an arm projecting out at each end, each arm containing a hole. A bronze knee is soldered to the interior of the front projecting arm over the center of the hole in such a manner to form a sight which is used for quick sighting. The open sight is secured to the rotating head cover by two open sight retaining screws.

The principal parts of the azimuth mechanism are the azimuth-worm wheel, azimuth worm, azimuth-worm bushing, azimuth-worm wheel support, azimuth-worm wheel cover, worm knob, azimuth micrometer, and azimuth scale.

The azimuth scale is retained upon its bearing, provided on lower end of the rotating head, by the azimuth-scale retaining ring which in turn is secured by four azimuth-scale retaining ring screws. The four elongated holes in the azimuth scale provide for adjusting. The scale, engraved upon the lower, exterior diameter, is graduated into 64 equal divisions, numbered every 2 divisions.

The azimuth-worm wheel cover forms a housing for the movable parts of the azimuth mechanism and provides seats for the azimuth-worm bushing and deflection worm wheel and support ring. The arrow, engraved upon the azimuth index which is dovetailed in the upper exterior diameter of the azimuth-worm wheel cover, coincides with the graduations of the azimuth scale. The scale engraved upon a boss on the rear face of the azimuth-worm wheel cover is used for measuring the deflection of the object.

The felt washer, which is retained in its seat, is located in the upper end of the azimuth-worm wheel cover, and provides for sufficient friction between the rotating head and the azimuth-worm wheel cover.

The azimuth-worm wheel support spring tends to retain the azimuth-worm wheel upon the azimuth worm wheel support.

The gear teeth of the lower part of the azimuth-worm wheel mesh with the rotating head pinion, which upon rotation moves the rotating head mechanism. The lower part of the azimuth-worm wheel support screws into its threaded seat provided in the upper part of the shank.

The azimuth worm is mounted eccentrically within the azimuth-worm bushing, which in turn has the azimuth-worm lever secured to it by the azimuth-worm lever screw. The bushing spring is provided for retaining the azimuth-worm bushing in position when the azimuth worm is in mesh with the azimuth-worm wheel. The azimuth-worm lever is so designed and arranged upon the azimuth-worm bushing to form a throw-out device for the azimuth worm. The lever spring is provided for taking up all lost motion that appears lengthwise in the mechanism. The worm knob is secured upon the end of the azimuth worm by a steel taper pin, the periphery be-



ing straight knurled to facilitate turning. The arrow, engraved upon the German silver piece, which is dovetailed in the end of the azimuth-worm bushing, coincides with the graduations of azimuth micrometer. The azimuth micrometer is held on the slotted end of the azimuth worm by the locking screw. The scale is divided into 100 equal divisions, numbered every 5 divisions. One complete revolution of the azimuth micrometer is equal to the distance between each graduation on the azimuth scale.

The rotating prism mechanism consists principally of the rotating prism, rotating prism holder, rotating prism supporting sleeve, rotating prism pinion, and rotating prism block.

The rotating prism is of rectangular cross section, mounted and retained in position within the rotating prism holder by rotating prism block which is secured by the rotating prism set screw. The rotating prism holder is seated in the upper section of the rotating prism supporting sleeve. The rotating prism pinion is driven upon the pinion shaft. The rotating head pinion is driven upon the hub of the rotating prism pinion. The pinion shaft is mounted at both ends in its seat provided in the azimuth-worm wheel support which, upon rotation, moves the pinion shaft. This gear system is so designed that the rotating head moves twice the angular distance of the rotating prism holder.

The principal parts of the deflection mechanism are the deflection-worm wheel and support ring, deflection worm, deflection-worm bushing, deflection dial, and worm knob.

The deflection-worm wheel and support ring is seated within the azimuth-worm wheel cover by a threaded surface and then retained by three deflection-worm wheel and support ring screws. A segment, projecting downward into the shank, carries a worm wheel which meshes with the deflection worm. The deflection-worm wheel support is located within the shank and against the deflection-worm wheel and support ring by two dowel pins, and secured by two deflection-worm wheel support screws.

The deflection worm is mounted eccentrically within the deflection-worm bushing which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the deflection-worm wheel and support ring.

The deflection-worm bushing is adjusted by using the fingers upon the rear end and is restrained in position by the deflection-worm bushing clamp plug, which is secured by the deflection-worm bushing clamp plug screw. A German silver piece is primed to the rear end of the deflection-worm bushing on which is engraved three arrows with letters "R" and "L." The middle or large arrow coincides with the graduations of the deflection dial. The compensating spring is provided for taking up all lost motion that appears length-

wise in the mechanism. The worm knob is secured to the deflection worm by a taper pin, the periphery being straight knurled to facilitate turning. The deflection dial is held on the front, slotted end of the deflection worm by the locking screw. The scale, engraved upon the front end, is graduated into 100 equal divisions, numbered every 10 divisions. The shank forms a body for the instrument and provides seats for the azimuth-worm wheel support, deflection-worm bushing, and elbow. The front surface is provided with a T lug which fits into a corresponding slot in the upper end of the shank of the rear sight. Upon the rear surface is dovetailed the deflection index, which is retained in place by the deflection-index screw. The arrow engraved upon the deflection index coincides with graduations upon the rear face of the azimuth-worm wheel cover.

The eyepiece consists principally of the reticule, reticule cell, achromatic field lens, achromatic eye lens, and eye lens cell.

The achromatic objective lens is mounted in the upper end of the objective lens cell. This cell is secured in its threaded seat in the upper end of the elbow by two objective lens cell retaining screws.

The elbow is screwed in the lower end of the shank and secured by the four elbow retaining screws in such a manner that its projecting aim is horizontal to the axis of the instrument. The elbow provides seats for the lower reflecting prism and the eye lens cell. The lower reflecting prism is held upon its bearing surfaces, provided in the elbow by two wedges which in turn are secured by the two wedge screws. These screws are retained by the wedge screw lock screw. The wedge screw cover is provided to retain the wedge screw lock screws in position. The wedge screw cover is secured by the wedge cover screw. The openings of the elbow upon the right and left sides are closed by the elbow covers, which are locked by the elbow cover screws. Upon the left side of the elbow is an opening through which the light is thrown upon the reticule. This opening is covered by the window to protect the interior of the eyepiece from dust and dirt. The shutter is so designed to slide over the opening in the elbow being guided by the shutter stop screw and movement limited by the elongated slot.

The reticule has two cross lines etched on its surface and is mounted in the forward end of the reticule cell which is secured in the eye lens cell by the reticule cell retaining screw.

The achromatic eye lens is mounted in the eye lens cell and is separated from the achromatic field lens by the lens separator. The achromatic field lens is held within the eye lens cell by the field lens retaining ring, which in turn is locked by the field lens cell retaining ring screw. The eye lens cell is secured to the elbow by the eye lens cell retaining screw.



All interior metallic surfaces exposed to the refracted light are finished with dull black baking enamel. All exposed optical elements, covers, and nonrotating joints are sealed with the litharge cement or equal. All German silver graduated surfaces are sandblasted and lacquered.

#### THE RANGE QUADRANT.

[Plate XXXIII.]

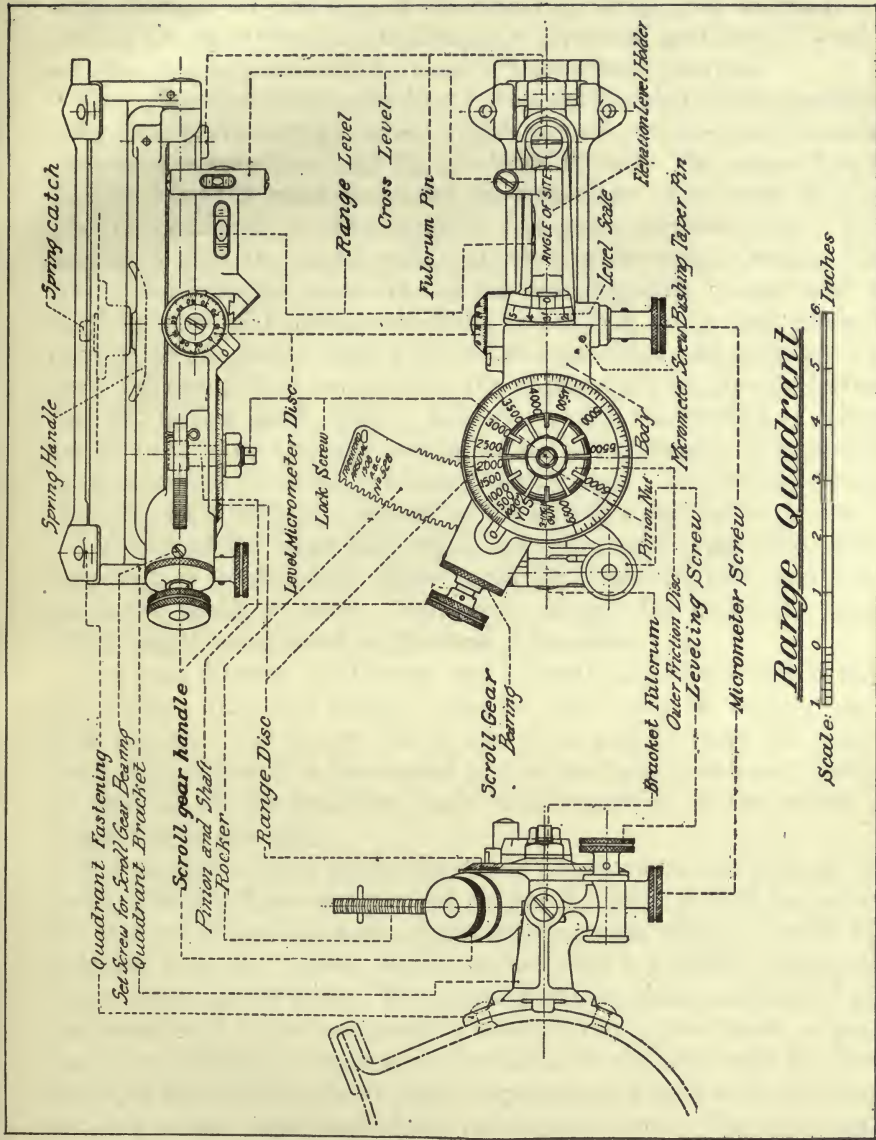
In this carriage the elevating and traversing mechanisms being entirely independent of each other, the laying of the gun may be much simplified and the time required be considerably lessened by assigning to one gunner the laying for direction and to a second that for range. Such a division of duties is provided for by the elevating crank at the right side of the trail. By this arrangement the gunner on the left of the piece using the open or panoramic sight lays for direction only, while the gunner on the right trail seat gives elevations by means of the range quadrant.

The range quadrant consists of the quadrant bracket, rocker, body, scroll gear, range disk, and range and cross levels with suitable leveling screws.

A quadrant-bracket fastening riveted to the right side of the cradle has dovetailed guides in which the quadrant bracket fits and is held by a spring catch. Two bracket fulcrums screwed into arms on the bracket project into bearings in the ends of the rocker, assembling the latter to the bracket and at the same time permitting it a motion of rotation about an axis joining the centers of the bracket fulcrums or trunnions. As assembled, this axis of motion is parallel to the axis of the gun. A projection below the rear end of the rocker forms a seat for a leveling screw, the axis of which is in a plane perpendicular to the axis of the gun. The knurled head of this screw projects to the right and its threads mesh in the segment of a worm wheel cut on the quadrant bracket. This leveling screw is thus arranged to rotate the rocker on its trunnions and, in conjunction with the cross level mentioned below, enables the quadrant to be brought into a vertical plane parallel to the axis of the gun. This construction is necessary to correct for difference of level of wheels and to give true quadrant elevations. At the front end of the rocker is the seat for a fulcrum pin, which forms the center of motion of the quadrant body. At the rear end of the rocker a curved arm projects upward which has circular racks cut on its front and rear edges. This curved arm passes through a slot in the body and the centers of the racks coincide with its center of motion.

The body, as stated above, is pivoted on the rocker. Its rear end affords a housing for the scroll gear and a seat for the range disk. The scroll gear meshes with the rear circular rack of the rocker. The







scroll gear is actuated by a knurled handwheel, which projects upward and to the rear. Turning the handwheel rotates the body on its fulcrum pin, moving its rear end up or down on the curved arm of the rocker. The scroll gear is pressed against its rack by a spring; large changes of position of the quadrant body may be made by pulling the handwheel out to disengage the scroll gear from the rack and then moving the body by hand to the desired position.

The range disk is assembled on a steel shaft seated in the quadrant body; this shaft carries a pinion which meshes with the front circular rack on the curved arm of the quadrant rocker. The range disk is held between the inner and outer friction disks. The outer friction disk on quadrants is split radially and has a serrated edge. This combined with the slight spring allowed in the outer friction disk forms an adjustable yet secure lock for the range disk. A nut screwed on the pinion shaft clamps the disks in position, and a lock screw in the end of the pinion shaft prevents the nut from unscrewing. The inner friction disk is connected to the pinion shaft by lugs projecting into the pinion shaft collar. A spiral spring, the tension of which serves to take up any lost motion in the arrangement, is connected at its outer end to the inner friction disk by a pin. It is wound around the hub of the body and secured to the hub in a slot cut to receive it.

The face of the range disk, which is visible on the right side of the quadrant, is graduated to 6,500 yards for model of 1902, and 8,000 yards for model of 1916. The caliber of gun for which the range disk is made is engraved on the face of the disk.

The least division is 50 yards, and the scale is dimensioned at each 500 yards. Divisions smaller than 50 yards may be readily made with the eye. The range disk is always in gear through the pinion shaft with the rack on the curved arm of the rocker, and any change in position of the quadrant body with reference to the rocker is registered by the disk.

The elevation level holder is seated on the forward part of the body, with its front end pivoted on the fulcrum pin of the latter. Its rear end is finished with a segment of a worm wheel, cut with the fulcrum axis as a center, which meshes with a vertical micrometer screw seated in the body. The amount of the relative motion of the elevation level holder and body is measured by a level scale, consisting of an ordinary circular scale dovetailed in the body with the level index on the elevation level holder supplemented by a level micrometer disk on the upper end of the micrometer screw. The level scale is graduated in sixty-fourths of the circumference, and one complete turn of the screw moves the level holder through one of these divisions. The level micrometer disk on the head of the micrometer screw has 100 divisions, so that one of these divisions corresponds to one mil. The divisions of the level scale are marked 2, 3, 4, and 5,



and in connection with the level micrometer disk are read 200, 300, etc., plus the indication of the latter. The 3 or 300 mark corresponds to the mean or zero position of the elevation level holder. The level holder is fitted with two spirit levels of a sensitiveness of 0.1 inch, which equals five minutes of arc. The longitudinal or range level is located so that its axis is parallel to the axis of the gun when the level scale is set at 3 and range disk at zero.

The axis of the transverse or cross level is perpendicular to that of the range level and also to the plane of motion of the quadrant body. The cross level in connection with the leveling screw enables the rocker and body to be kept vertical. The range level in connection with the elevation-level holder and its level screw is used as a clinometer to correct the range-disk readings for angle of site; in connection with the body it is used as the range quadrant level. For purposes of reference, these levels are designated as the cross level and the range level, and their respective screws as the leveling screw and micrometer screw; the scale pertaining to the latter screw is called the level micrometer disk. The range level is also referred to at times as the quadrant or angle of site level.

#### USE OF SIGHTS AND QUADRANTS.

By construction and method of mounting with longitudinal and cross levels on the rear sight, the panoramic sight forms a horizontal angle measuring instrument. These angles are read directly from the deflection scale of the sight in units, mils, equivalent to  $\frac{1}{6400}$  of a complete circle, or  $360^\circ$ .

#### USE OF THE PANORAMIC SIGHTS, MODELS OF 1904 AND 1915.

*For direct aiming.*—Set the rear sight at the required elevation and correct for difference of level of wheels; set off the desired deflection on the azimuth circle of the panoramic sight; bring the crosslines of the sight upon the target by means of the elevating and traversing devices of the carriage. For imparting the approximate initial direction the line sight may be used with advantage.

*In using the model of 1915 sight for direct fire, care must be taken that the rotating head be set at 300 mils and the deflection mechanism at 0.*

*For indirect aiming.*—Set the rear sight at the required elevation and make correction for difference of level of wheels; set the azimuth circle of the panoramic sight at the deflection ordered. Lay the gun for deflection by directing the vertical line of the panoramic sight at the auxiliary aiming point, the elevation of the gun being given by using the range quadrant. The angle of deflection to be set off on the azimuth circle of the panoramic sight is the same as the angle

made by joining the target and the auxiliary aiming point with the sight.

*For measuring ranges.*—Distances or ranges may be roughly calculated from readings made by two panoramic sights mounted on their guns, as follows:

Direct the guns on the target; then sight the panoramic sights on each other. The angle at the target subtended by the line connecting the two guns is then 3,200 mils minus the sum of the actual angles in mils measured at the guns.

If B is the distance between the guns in yards, then range equals B multiplied by 1,000 divided by the number of mils in the angle at the target.

The accuracy of this method increases as B becomes smaller so long as the instruments can be read correctly.

#### USE OF THE RANGE QUADRANT.

*To give quadrant elevations with the range quadrant.*—Set the range disk for the desired range by turning the scroll gear handle, and correct for difference in level of wheels; correct for angle of site on the scale of the elevation-level holder; bring the bubble of the range level to the center by elevating or depressing the gun. The gun will then have the elevation (corrected for angle of site) corresponding to the range.

#### CARE OF SIGHTS AND QUADRANTS.

Whenever convenient, and especially when in garrison and not in use, the front and rear sights with the range quadrants and panoramic sights should be removed from the carriages and kept in some dry place, as in the barracks' storeroom or office.

#### CARE OF THE FRONT AND REAR SIGHTS.

For traveling the front sight is covered by the duck cover supplied for the purpose; and by means of the spring catch at the base of the bracket, it is turned 105° from its firing position to the rear and locked to the front-sight bracket support. The shank is withdrawn from the shank socket, covered with the cover for shank and placed in the sight box provided for it in the trail of the carriage. A duck cover, called the cover for rear-sight bracket, is provided to protect the surfaces of the shank socket and should be slipped over the shank socket when the shank is removed.

All parts of the shanks and shank sockets should be kept clean, free from rust, and lightly oiled. When stored or not used for short periods, they should be thoroughly cleaned and well coated with light slushing oil. Should any part become rusted, it should be



carefully cleaned by softening the rust with coal oil and rubbing with a soft pine stick.

In handling all parts of the sights care must be exercised to avoid injuring them by dropping, striking them upon or with other parts, etc. The front-sight bracket *must not* be used by the cannoneers as a handle to assist in mounting upon or dismounting from the axle seat or otherwise.

To clean the joint between the rear-sight bracket and the shank socket, drive out the taper pin from the end of the leveling screw and remove the leveling screw. Disassemble the shank socket from the rear-sight bracket, clean all parts, and oil them with sperm oil. Assemble in the reverse order.

Oil the leveling screw from time to time through the oil hole provided in the rear-sight bracket.

For instructions for the replacement of level vials see instructions given under the heading "Care of the range quadrant."

#### CARE OF THE PANORAMIC SIGHT, MODELS OF 1904 AND 1915.

These sights are delicate instruments and must not be subjected to any rough usage, jars, or strains. In firing they remain in position on the carriage; in the field, when not in use, they are kept in the padded leather cases prepared for them on the rear of the main shield.

To obtain satisfactory vision, the glasses must be perfectly clean and dry. The T lug on the sight and the slot forming its seat should be kept lightly oiled as a preventive of rust. The worm and worm rack should be oiled with vaseline. When dust accumulates on the pointers it should be removed by a fine camel's-hair brush in the hands of an experienced person.

To disassemble the worm mechanism of the model of 1904 sight for cleaning, throw out the worm-box eccentric lever, disengaging the worm from the worm gear of the azimuth circle. Insert a pin in the radial hole in the spring-box pin. Throw the worm-box eccentric lever back and engage the worm in the azimuth circle. Push the spring box toward the worm knob about three-eighths inch and then lift it straight out. Take out the eccentric-lever stud and remove the worm-box eccentric lever. Pull out the dowel in the worm-box pin with a pair of pliers and drive out the worm-box pin. Then pull out the worm box and worm complete. The worm may be cleaned without further disassembling. Assemble in reverse order.

The teeth of the worm wheel may be cleaned without disassembling the hood.

To clean the rotating-head window and the front face of the rotating-head prism, unscrew the window cell in the rotating head. Do not remove the rotating-head window from the window cell.



To clean the reticule and eyepiece lenses, remove the screw holding the eyepiece to the eyepiece elbow and unscrew the eyepiece. To disassemble the lenses, remove the set screw on the underside of the eyepiece and unscrew the eye-lens cell. The field lens is held in place by a retaining spring, both of which may drop out as soon as the eye-lens cell is disassembled.

In assembling note that the flat surface of the field lens of the eyepiece is placed next to the reticule. Do not remove or change the adjustment of the reticule. Its rear surface may be cleaned with a camel's-hair brush after the eyepiece has been removed.

*In panoramic sights of serial numbers after No. 752 the exposed optical elements and all nonmoving joints are sealed and no attempt should be made to remove them.*

For serial numbers 873 and up, the slight change in the appearance and construction of the elbow and rotating head is made for the purpose of making these parts dust and moisture proof.

#### CARE OF THE RANGE QUADRANT.

The directions for the care of the range quadrant are practically the same as those for the care of the different sights. The parts should be kept clean, free from rust, and bearings lightly oiled. When stored they should be coated with light slushing oil.

To clean the micrometer screw, remove the screw in the center of the micrometer dial, turn the micrometer screw until the dial is forced off; drive (away from gun) the taper pin holding the screw bushing. Pull out the screw bushing, clean, oil with a heavy oil, and assemble in the reverse order and adjust.

Extra glass level vials assembled in brass tubes, to replace broken vials in sights and range quadrants, except for the range levels of quadrants, will be issued on requisition. In case the range level of the range quadrant requires replacement the range quadrant will be turned in to an arsenal designated by the armament officer.

Only ordinary tools, such as a hammer and a punch or a piece of wire, are required for the removal of pins from level caps in order to replace vials. All pins on level caps are driven in toward the center of the instrument. They should be driven out in the opposite direction. Four adjusting screws in the vial tubes are used for adjusting the tubes in their holders.

#### ADJUSTMENT OF SIGHTS AND QUADRANT.

The sights are correctly adjusted when, at zero elevation and deflection, the line of sight is parallel to the axis of the bore.

The range quadrant is correctly adjusted when, with the range disk set at zero, level scale set at 300, and axis of gun horizontal and corrected for difference of level of wheels, the level bubble of the

range level stands in the center of its vial. In adjusting sights, the panoramic sight should first be corrected. If the rear sight is adjusted first, it will require readjustment if the subsequent adjustment of the panoramic sight causes a change in position of the rear-sight range strip.

#### TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1904.

Direct the panoramic sight by means of the worm knob and scroll gear handle until its line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is described hereafter. Without disturbing the direction of this line of sight, move the worm index of panoramic sight and the range strip of the rear sight until the zero marks come opposite their respective indices. The worm index may be moved after loosening the nut on the end of the worm. This nut may be loosened by the combined teat wrench and screw driver issued for the purpose. If the worm index can not be readily removed, grasp the sight by the worm index, release the worm from the worm gear of the azimuth circle, and gently tap the exposed end of the worm with a small piece of wood or soft metal.

To locate the index of the panoramic sight opposite the zero of the scale, loosen the four screws that hold the movable index cover in place and move this cover until the index is properly located; then tighten the screws. Movement of the range strip of the rear sight is made possible by a dovetail slot in the shank in which the range-strip screw can be moved when the nut has been loosened.

#### TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1915.

Should backlash or lost motion appear lengthwise within the elevation device, it can be removed by loosening the elevation-worm retaining-nut screw, setting up on the elevation-worm retaining nut and then tightening up on the elevation-worm retaining-nut screw. To remove backlash between the threads of the elevation worm and worm teeth of the elevation segment, loosen the bushing clamp plug screw which releases the elevation-worm bushing-clamp plug, and then turning the elevation bushing, in which the elevation worm is eccentrically mounted, so as to bring the elevation worm closer in contact with the worm teeth of the elevation segment. The elevation-worm adjusting clamp plug must be firmly clamped after adjusting by tightening up on the bushing clamp plug screw to secure the elevation-worm bushing against rotation. After adjusting, should the zero, upon the elevation-worm micrometer head not coincide with its index when the elevation index coincides with the graduations of the scale upon the rear face of the rotating head, it can easily be remedied by the loosening up on the locking screw and turning the



elevation-worm micrometer head until the zero just coincides with its index, after which it must be firmly secured by tightening up on the locking screw.

Backlash between the threads of the azimuth worm and the worm teeth of the azimuth worm wheel is taken up by the bushing spring. The four elongated holes in the azimuth scale afford means for adjusting when its zero does not coincide with the arrowhead upon the azimuth index when the zero of the deflection scale, upon the rear of the azimuth worm-wheel cover, coincides with arrowhead upon the deflection index. After this adjustment is made the azimuth micrometer should be inspected similar to that of the elevation-worm micrometer head.

Backlash, that appears between the threads of the deflection worm and the worm teeth of the deflection worm wheel and support ring, can readily be removed when the method of adjusting similar to that of the elevation device is followed out.

#### TO ADJUST THE FRONT AND REAR SIGHTS.

Set the range strips at zero elevation and move the peep sight and the front sight until the line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is given below. Now shift the deflection scale on the rear sight, after loosening the two screws, until its zero is opposite the index on the peep sight.

Movement of the front sight is accomplished by turning the front-sight bracket sleeve, after first removing the split pins.

#### TO ADJUST THE RANGE QUADRANT.

Elevate or depress gun until its axis is horizontal, correct for difference of level of wheels, set the level scale of the quadrant at 300, then turn the scroll gear handle until the range-level bubble is centered. Now turn the range disk of the quadrant until its zero coincides with the range index. The range disk is held between two friction disks secured by a nut and lock screw and it is only necessary to unscrew these to release the disk and correct its position. To test the horizontality of the gun use the testing level issued for that purpose. This level has two arms perpendicular to each other, and a level vial is inserted in each arm. As the faces of the breech and the muzzle are perpendicular to the axis of the bore, the horizontality of the axis of the bore may be determined by placing one of the arms of the testing level against the face of the breech or muzzle and elevating or depressing the gun until the bubble in the level of the other arm is in the center. Then apply the other arm to the same face and the bubble in the first arm should also be in the center of its vial. If not, the testing level requires adjustment.



## VERIFICATION OF PARALLELISM OF LINES OF SIGHT AND AXIS OF BORE.

The adjustment of the sights and range quadrant is of such importance and should be verified so frequently that battery commanders will find it advantageous to make permanent arrangements for such verification. The leveled supports constituting the carriage emplacement should preferably be of stone. The site of the target (fig. 1) should be prepared, and the exact locations of the target and horizontal reference points permanently marked. If these arrangements are properly made, subsequent verifications of sights and range quadrants will become a simple matter.

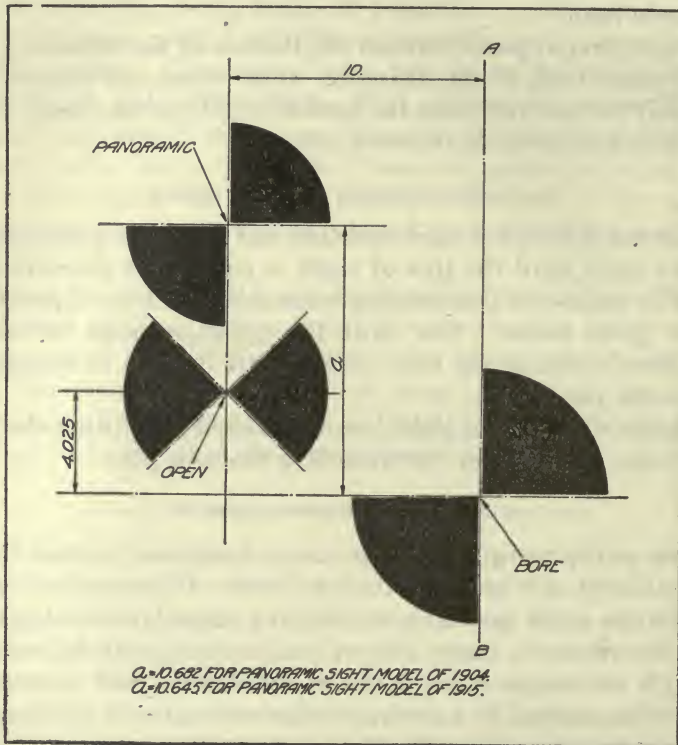


FIGURE 1

A target of dimensions given in figure 1 is placed in a vertical position perpendicular to the line of sight, at such a height that the point "bore" is at the same height as the axis of the bore of the gun. The verticality of the target is assured by a plumb line attached at A, coinciding with the vertical line AB.

The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled so as to bring the axle axis horizontal. Now direct the gun so that the prolongation of the axis of the bore, as determined by the

bore sights, pierces the target at the proper point; the lines of sight of the open and panoramic sights are then adjusted in direction by the means explained above until they pierce the targets in the points marked, respectively, "open" and "panoramic."

The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore it should be shimmed all around with tissue paper until it does so. For a muzzle-bore sight use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 yards or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

#### ADDITIONAL TESTS.

After the sights and range quadrant are adjusted they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:

(a) With carriage level and gun and sights at zero elevation and deflection, the lines of sight and axis of bore prolonged pierce the target (fig. 1) in the proper points.

(b) The gun is then moved to its maximum elevation; as the sight elevation is altered, the lines of sight should follow the vertical lines through the same points of the target (fig. 1).

(c) With conditions as in (a), the gun is moved upon the carriage to its extreme positions in azimuth; as the sight deflections are now altered, the lines of sight should follow the horizontal lines through the same points on the target (fig. 1).

(d) With conditions as in (a), the range-quadrant disk registers 0. As the gun is elevated and the sight elevation changed to bring the line of sight to bear upon the proper point of the target (fig. 1), the readings of the range disk, quadrant leveled, should agree at all ranges with those of the elevation scale of the sight.

By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy. If error be noted, a report of the facts of the case with the cause, if known, should be made to the ordnance officer charged with the repair of the matériel for his information and action.

#### SPARE SIGHTS AND QUADRANT.

To each battery is issued one set of spare sights, consisting of one front sight complete, one rear sight complete, one panoramic sight, and one range quadrant. These parts are carried in a special packing chest in the battery wagon. One set of bore sights (consisting of one breech and one muzzle bore sight) and one level for use in adjusting sights, etc., are also issued to each battery.

#### ADJUSTING INSTRUMENTS.

A complete detailed description of the method of disassembling and adjusting the different instruments is given in Ordnance Office Pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire-Control Systems for Coast and Field Artillery. Attention is invited to General Orders No. 47, War Department, March 24, 1905, with reference to the care and repair of panoramic sights. No disassembling of instruments except as prescribed herein will be permitted. The disassembling of telescopic instruments allowed herein must be done only in the presence of a commissioned officer. Disassembling as permitted in Pamphlet 1795 must be done only by officers or employees of the Ordnance Department.

#### ACCURACY OF FIRE.

The two essentials for good shooting are good matériel and skillful personnel. There is practically no limit to improvement in personnel, which may be accomplished by careful training. Improvements in matériel are the subject of constant investigation.

#### CAUSES OF INACCURACY.

The chief causes of unavoidable inaccuracy are—

(a) Variations in the action of the gun and mount and in the ammunition.

(b) Variations in the atmospheric conditions, the effects of which can not be determined accurately.

#### INACCURACIES FOR PERCUSSION FIRE.

Variations in the action of the gun and mount cause a variable "jump," which alters the angle of departure.



Variations in the powder charges and projectiles cause variations in the initial velocities, and the flight of the projectile is further influenced by the variations in the atmospheric conditions.

#### INACCURACIES FOR TIME FIRE.

In addition to the above causes for inaccuracy for percussion fire, the principal causes for inaccuracy of time fire are variations in the action of the fuze, which arise from variations in—

- (a) Time of ignition of time train.
- (b) Rate of burning of the time train.
- (c) Time of transmission of the flame from the time train to the base charge.

#### RANGE ERRORS.

We are principally concerned with the inaccuracies in range, since those in the lateral direction, due to matériel, are so small as to be negligible. However, the latter are given also.

From firings conducted with each type of gun and ammunition, from which the errors of personnel have been eliminated as far as practicable, range tables are compiled, and a measure of the accuracy is obtained in the following manner:

From the ranges and deviations obtained at each elevation the mean values are computed. The difference of each round from the mean value gives the error, and the mean of the errors affords a measure of the accuracy.

The following table illustrates this method:

No. of rounds.	Range.	Variation from mean.	Deviation right, drift.	Variation from mean.
	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>
1.....	5,973.6	26.4	62.4	7.1
2.....	5,978.0	22.0	58.7	3.4
3.....	6,026.0	26.0	53.1	2.2
4.....	5,956.6	43.4	48.0	7.3
5.....	6,053.6	53.6	49.2	6.1
6.....	6,012.2	12.2	60.4	5.1
Mean.....	36,000.0 6,000.0	183.6 30.6	331.8 55.3	31.2 5.2

The second column in the above table gives the actual ranges. The mean range is obtained by adding all together and dividing by 6, since 6 rounds are considered.

The third column contains the error or difference of each round, irrespective of sign, from the mean range just found. The mean of these differences is then obtained and called the mean error in range. Evidently, if all the projectiles fall nearly at the same range this mean error will be small.

The fourth column gives the lateral deviation from the direction in which the axis of the bore points before the piece is fired. The mean deviation is at the bottom of this column.

The fifth column gives the differences from this mean, with a mean at the bottom called the mean error in deviation or mean lateral error.

Collecting the results from the table, we have:

	Yards.
Mean range.....	6,000
Mean longitudinal error.....	30.6
Mean deviation right.....	55.3
Mean lateral error.....	5.2

When the position of the center of impact on the horizontal plane is known, figure 2 shows how the magnitude of the angle of fall determines the position of the center of impact on a vertical target. Thus,

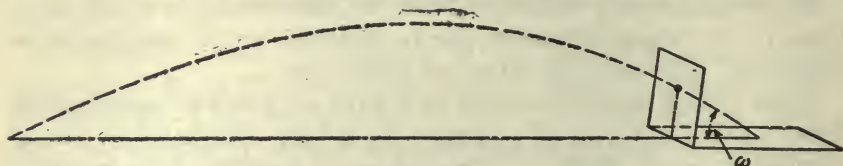


FIGURE 2.

if  $\omega$  be the angle of fall, and if the horizontal target is struck at a distance  $l$  from the vertical one, the latter will be struck at a height which equals  $l \tan \omega$ .

The angle of fall of the 3-inch shrapnel at 6,000 yards is known to be  $23^\circ 40'.9$  and the mean range error of the point of burst of a series of rounds is 30.6 yards for the same range, then the

$$\begin{aligned}\text{Mean vertical error} &= 30.6 \tan 23^\circ 40'.9 \\ &= 13.4 \text{ yards.}\end{aligned}$$

Vertical targets are employed at the shorter ranges, because they may then be of moderate size, and errors due to inequalities of the ground are eliminated, but at long ranges targets can not generally be made large enough to catch all the rounds.

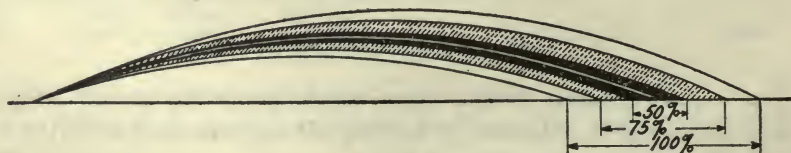


FIGURE 3.

The center of impact on a horizontal target is the intersection of the lines of mean range and mean lateral deviation, and on a vertical target it is the intersection of the lines of mean vertical and mean lateral deviation.

The mean trajectory is that which passes through the center of impact.

In figure 3 the central white line represents the mean trajectory, the dark band is that in which 50 per cent of the trajectories lie; the shaded band is that which contains 75 per cent, while the outer band contains the remainder. The width of these bands is exaggerated in figure 3 for the sake of showing them clearly.

#### PROBABLE ZONES.

It can be shown by the theory of probabilities that if each of the three mean errors is multiplied by the factor 1.69, the widths of

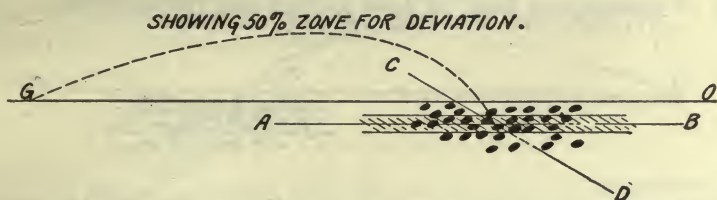


FIGURE 4.—Showing 50 per cent zone for deviation.

zones (of infinite length) which will contain 50 per cent of the hits are obtained.

The mean range error  $\times 1.69$  gives the width of the 50 per cent zone for range; the mean lateral error  $\times 1.69$  gives the width of the 50 per cent zone for deviation; the mean vertical error  $\times 1.69$  gives the width of the 50 per cent zone for height.

Thus, if GO, figures 4 and 5, represents the direction of the gun, and AB be a straight line parallel to it at a distance equal to the mean lateral deviation, and CD be a straight line at right angles

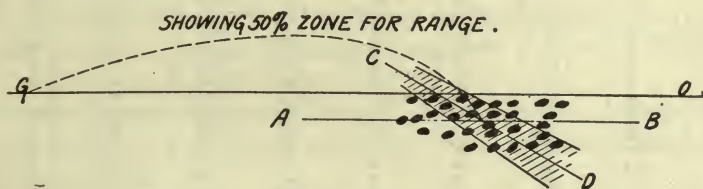


FIGURE 5.—Showing 50 per cent zone for range.

to GO or AB at a distance from the muzzle equal to the mean range; then if the zone in figure 4 called the zone for deviation, and that in figure 5 called the zone for range, each contains 50 per cent of the hits on the surface of the ground, their widths must be 1.69 times the mean lateral error and 1.69 times the mean range error, respectively. AB and CD are the central lines of these zones.

If now we look at figure 6, where these zones are superposed, we see a rectangle which must contain 50 per cent of 50 per cent, or 25 per cent of the total number of hits. In a similar manner the



25 per cent rectangle on a vertical target is made up of the intersection of the 50 per cent zones for deviation and height.

The relative accuracy of different guns at different ranges is estimated by the dimensions of this rectangle, which is called the 25 per cent probable rectangle.

At each range there is a horizontal and a vertical probable rectangle, the width of each is the same, as each has the same zone for deviation, but the relation of the length of one to the height of the other depends on the angle of fall.

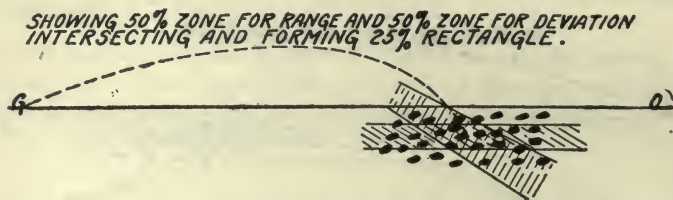


FIGURE 6.—Showing 50 per cent zone for range and 50 per cent zone for deviation intersecting and forming 25 per cent rectangle.

TABLE OF PROBABILITY FACTORS.

The following table gives the proportional width of other zones (containing a different percentage of hits) to one of 50 per cent as unity:

Per cent.	Factor.	Per cent.	Factor.	Per cent.	Factor.	Per cent.	Factor.
1	0.02	26	0.49	51	1.02	76	1.74
2	.04	27	.51	52	1.04	77	1.78
3	.06	28	.53	53	1.07	78	1.82
4	.07	29	.55	54	1.09	79	1.86
5	.09	30	.57	55	1.12	80	1.90
6	.11	31	.59	56	1.14	81	1.94
7	.13	32	.61	57	1.17	82	1.98
8	.15	33	.63	58	1.19	83	2.03
9	.17	34	.65	59	1.22	84	2.08
10	.18	35	.67	60	1.25	85	2.13
11	.20	36	.70	61	1.27	86	2.18
12	.22	37	.72	62	1.30	87	2.24
13	.24	38	.74	63	1.33	88	2.30
14	.26	39	.76	64	1.36	89	2.37
15	.28	40	.78	65	1.39	90	2.44
16	.30	41	.80	66	1.42	91	2.52
17	.32	42	.82	67	1.45	92	2.60
18	.34	43	.84	68	1.48	93	2.69
19	.36	44	.86	69	1.51	94	2.78
20	.38	45	.89	70	1.54	95	2.91
21	.40	46	.91	71	1.57	96	3.04
22	.41	47	.93	72	1.60	97	3.22
23	.43	48	.95	73	1.64	98	3.45
24	.45	49	.98	74	1.67	99	3.82
25	.47	50	1.00	75	1.71	100	

Taking the width of a 50 per cent zone as unity, the factors in the above table are the widths of other zones containing different percentages. Thus 80 per cent and 20 per cent zones are, respectively, 1.90 and 0.38 times as wide as the 50 per cent zone.

If the width of the 50 per cent zone is given in yards or feet, the widths of other zones containing different percentages can be obtained by *multiplying* by their corresponding factors. Thus if the width of a 50 per cent zone is 3 yards, the widths of 25 per cent and 72 per cent zones are  $0.47 \times 3 = 1.41$  yards and  $1.60 \times 3 = 4.80$  yards, respectively.

Conversely, if it is required to find what percentage will fall in a zone of given width, the factor must be obtained by *dividing* by the width of the 50 per cent zone.

Thus with the same 50 per cent zone (3 yards wide), as before, what percentages will fall in zones 2 yards and 6 yards wide? The factors are  $2/3 = 0.67$  and  $6/3 = 2.00$ , and they correspond to 35 per cent and 82.4 per cent, respectively.

#### DATA FOR 3-INCH FIELD GUN SHRAPNEL.

(Based upon firings at the Sandy Hook Proving Ground.)

The two tables following give data concerning the accuracy of the 3-inch field gun. The data for percussion fire and for time fire, column 7 of the table, are based upon extensive firings covering a considerable period of time, while those in columns 2, 3, 4, 5, 6, and 9 of the table for time fire are limited to the results obtained in testing 18 recent lots of fuzes (18,000 fuzes). This accounts for the apparent inconsistency of the values for the widths of the 50 per cent zones for range in the two tables. If these tables were based on firings of the same extent of the same ammunition, the widths of the 50 per cent zones for range to point of burst should be greater than the widths of the 50 per cent zones for range for the corresponding range in percussion fire.

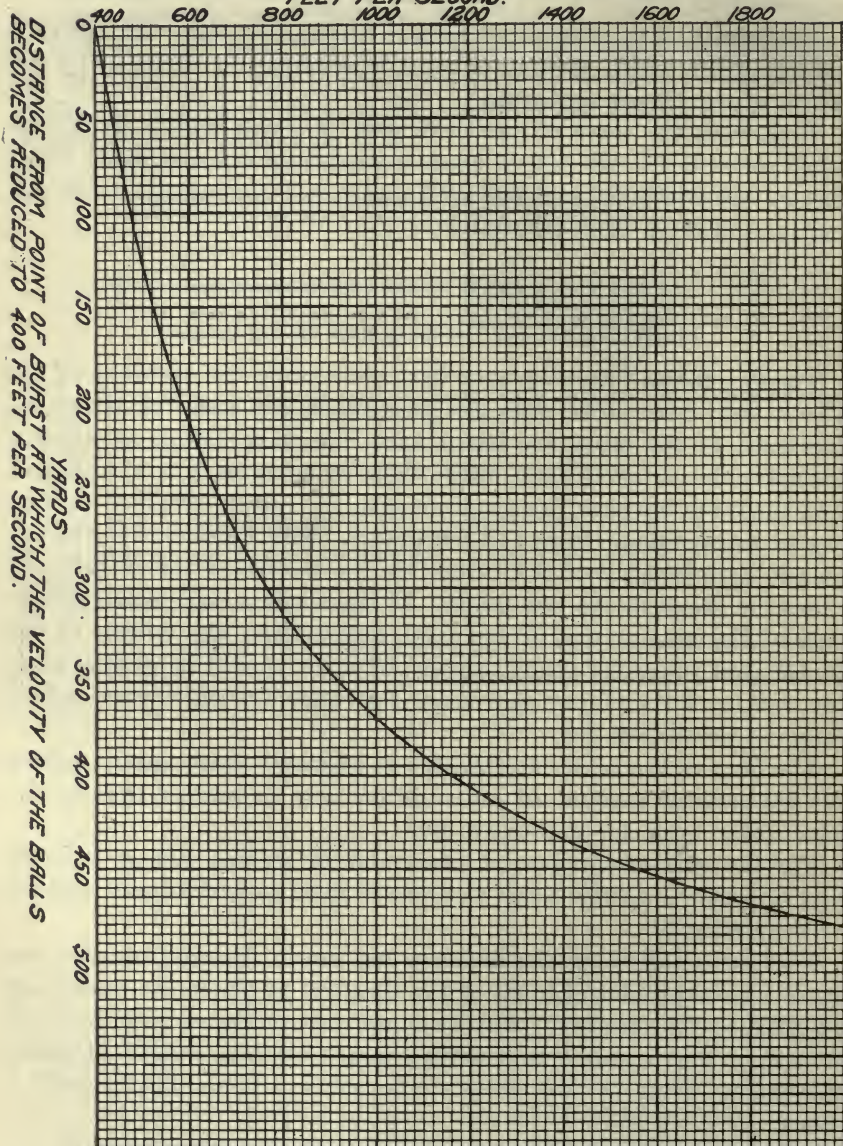
The data in the table for time fire is probably more nearly correct for the greater amount of ammunition now in service than is the data in the table for percussion fire.

For the greater number of fuzes now in service, firings indicate that to obtain a *normal burst a corrector of 33 should be used*, instead of the setting 30.

The curve following the tables is for use in determining the distance from the point of burst of the shrapnel at which the remaining velocity of the shrapnel balls becomes reduced below 400 feet per second, or that required to disable a man (400 f. s., weight of bullet 167 grains, gives 58 foot-pounds, the energy required to disable a man).



VELOCITY OF SHRAPNEL BALLS AT POINT OF BURST - EQUALS  
REMAINING VELOCITY OF PROJECTILE PLUS 275  
FEET PER SECOND.





*3-inch field gun—Shrapnel—Percussion fire.*

Range.	Horizontal target (length of 50 per cent rectangle).	Horizontal and vertical targets (width of 50 per cent rectangles).	Vertical target (height of 50 per cent rectangle).	Horizontal target (length of 25 per cent rectangle, width of 50 per cent zone for range).	Horizontal and vertical targets (width of 25 per cent rectangle, width of 50 per cent zones for deviation).	Vertical target (height of 25 per cent rectangle, width of 50 per cent zone for height).
Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.
0.....	0.0	0.0	0.0	0.0	0.0	0.0
500.....	12.9	.5	.13	8.27	.32	.083
1,000.....	24.8	.95	.63	15.90	.61	.403
1,500.....	35.6	1.8	1.64	22.82	1.15	1.05
2,000.....	45.4	2.4	3.28	29.10	1.54	2.10
2,500.....	53.9	2.9	5.49	34.55	1.86	3.52
3,000.....	61.5	3.96	8.30	39.42	2.54	5.32
3,500.....	68.6	4.6	11.76	43.97	2.95	7.54
4,000.....	75.2	5.3	16.05	48.21	3.40	10.29
4,500.....	81.1	6.6	21.16	51.99	4.23	13.56
5,000.....	85.8	8.45	26.94	55.00	5.42	17.27
5,500.....	89.5	10.8	33.43	57.37	6.92	21.43
6,000.....	92.4	13.7	40.52	59.23	8.78	25.97
6,500.....	95.1	17.4	48.69	60.96	11.15	31.21
7,000.....	97.2	21.9	58.20	62.31	14.04	37.31
7,500.....	99.2	27.2	69.30	63.59	17.44	44.42
8,000.....	101.0	33.2	82.60	64.74	21.28	52.95

*3-inch field gun—Shrapnel—Time fire.*

Range.	Average maximum dispersion in range to point of burst.	Average maximum dispersion in height of burst.	Average difference between mean actual and range table range to point of burst, 18 recent lots of fuzes.	Mean variation range to point of burst, 18 recent lots of fuzes.	Width of 50 per cent zone for range (point of burst).	Width of 50 per cent zone for deviation (point of burst).	Cone of dispersion of shrapnel balls (angle of).	Width of 50 per cent zone for height of burst.
Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	° ' "	Yards.
0.....	0.0	0.0	0.0	0.0	0.0	0.00	8 41	0.00
500.....	21.5	.2	.....	.....	.....	.32	9 54	.....
1,000.....	35.0	.9	.....	.....	.....	.61	11 06	.....
1,500.....	47.0	2.2	.....	.....	.....	1.15	12 06	.....
2,000.....	58.0	4.2	— 4.3	20.4	34.5	1.54	13 02	2.48
2,500.....	67.0	6.8	+ 4.2	22.0	37.2	1.86	13 52	3.80
3,000.....	76.0	10.3	+13.0	23.4	39.5	2.54	14 28	5.34
3,500.....	84.5	14.5	+21.0	24.8	41.9	2.95	14 54	7.22
4,000.....	92.5	19.7	+28.3	26.1	44.1	3.40	15 22	8.92
4,500.....	100.0	26.1	+34.7	27.4	46.3	4.23	15 48	12.18
5,000.....	107.0	33.6	+40.2	28.6	48.3	5.42	16 12	15.09
5,500.....	113.0	42.2	+44.8	29.6	50.0	6.92	16 32	18.52
6,000.....	119.5	52.4	+48.9	30.6	51.7	8.78	16 48	22.67
6,500.....	125.5	64.3	+52.5	31.6	53.4	11.15	17 05	28.11
7,000.....	131.0	77.8	+55.6	32.6	55.1	14.00	17 20	34.44
7,500.....	136.4	93.0	+58.4	33.5	56.6	18.00	17 35	43.54
8,000.....	141.7	110.0	+60.9	34.2	57.8	23.40	17 50	52.55

## GENERAL INFORMATION.

## PAINTING ARTILLERY MATÉRIEL.

The paint issued for this purpose is of olive-drab color put up in 5-pound cans ready for use, and is applied to both wood and metal parts. If the paint is too thick, turpentine should be used as a thinner, but not to greater extent than 2 per cent by volume.

All steel and iron nonbearing surfaces should be painted, including that portion of the underside of the gun between the clips. Wearing and bearing surfaces, teeth of gear wheels, elevating screws, piston rods, cylinders, counter-recoil springs, and interior of cradle should not be painted.

All parts to be painted should be free from dirt or grease. They may be washed in a liquid made by dissolving one-half pound sal soda in 8 quarts of warm water, then rinsed in clean water, and wiped thoroughly dry.

Where the matériel is in fair condition and only marred in spots, the marred places should be primed with olive-drab paint, second coat, and permitted to dry. Then the whole surface should be sandpapered with No. 1½ sandpaper and a coat of paint applied and allowed to dry thoroughly before use.

Where the matériel is in bad condition all parts should be thoroughly sandpapered with No. 2½ sandpaper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sandpapered with No. 00 sandpaper, apply a finishing coat, and permit the parts to dry thoroughly before use.

In general, two coats of paint per year will be sufficient to keep the matériel in good condition. After repeated painting the paint may become so thick as to scale off in places or give an unsightly appearance. It may then be removed for repainting, as follows:

Dissolve 1 pound of concentrated lye, powdered form, in 6 pints of hot water, and slake in enough lime to give the solution the consistency of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface use a scraper to remove the old paint, and complete the cleaning of the surface with cloth and water. If one application is not sufficient to loosen the paint, apply a second coat. Before painting wash the surface with sal soda water, rinse with clean water, and then wipe thoroughly as described above.

#### OILS FOR ARTILLERY MATÉRIEL.

For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil, clock oil, sperm oil, coal oil, neat's-foot oil, and light slushing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages *and for no other purpose.*

The lubricating oil will be used exclusively in all oil holes of the matériel and in lubricating such parts as wheels and axles, gun and



cradle slides, pintle socket, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breechblocks, threads of breech recess, etc.

Clock oil should be used on the spindle and all bearings of the battery commander's telescope, bearings of the panoramic sight, range quadrant, and fuze setters, and on the observation telescope, field artillery plotter, and worms of the rear sight.

In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the lubricating oil and may be used on the gears of sights, fuze setters, range quadrants, parts of revolvers, etc.; lubricating oil may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster's Department.

Neat's-foot oil is used for the care and preservation of all leather equipment.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for an appreciable length of time. Its use as a lubricant for mobile artillery is forbidden.

Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricating oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a *thin, uniform coat*, since this is ALL that is necessary to give good protection.

Except in very cold weather it can be applied by using a paint brush as when painting; in cold weather it should be applied by stippling; that is, lightly tapping the surface with the end of the sash tool held with bristles perpendicular to the surface to be covered. It can be applied to the bores of guns by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of guns.

It may be readily removed by the use of burlap or waste dipped in coal oil.

#### REPAIRS FOR FIELD ARTILLERY MATÉRIEL ISSUED TO THE UNITED STATES ARMY AND THE NATIONAL GUARD.

Instructions relative to making repairs to field batteries and furnishing ordnance stores and supplies for them will be found in the general orders issued by the War Department from time to time.



Instructions in reference to the care, use, and repair of delicate instruments, such as sights, telescopes, and range finders will be found in General Orders, No. 47, War Department, Washington, March 24, 1905, and in O. O. Pamphlet No. 1795.

#### SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.

Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are scattered throughout the text of this handbook; some of the more important are here condensed for more convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

The firing pin should habitually be carried uncocked.<sup>1</sup>

Recock carefully with a lanyard after a hangfire or a misfire.<sup>1</sup> The breechblock should not be opened for at least one minute after a misfire.

All work upon recoil cylinders, sights, and other optical equipment should be done in the presence of a commissioned officer.

The recoil cylinder should never be clamped in a vise, but when necessary to hold it from turning a spanner applied to front end of cylinder should be used.

Never remove the cylinder end stud nut when the piece is at an elevation.

See that proper kind of oil is used in cylinders and for lubrication.

Strain the oil used in filling the cylinders through a fine clean cloth and be sure that the receptacles used in handling the oil are clean.

Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

In assembling the gland be sure that at least four threads of the gland are engaged with the threads of the cylinder head.

Lash parts with copper wire to prevent unscrewing.

Before firing, inspect to insure that cylinders are properly closed and that the cylinder-end stud nut and the piston-rod nut are in place.

If time permits, oil slides before firing.

Note length of recoil for first few shots to insure that the recoil mechanism is working properly.

If the gun fails to return fully into battery, it is probably due (1) to dirt on slides and guides; (2) to cutting of sliding surfaces on account of dirt and lack of oil; (3) to gland being screwed up too tightly; (4) to dirt or foreign particles in the cylinder, and especially in the counter-recoil buffer recess; (5) to weakness of springs. Ninety per cent of such cases will be found due to (1), (2), or (3).

<sup>1</sup> This applies to the 3-inch gun, model of 1902, only.

Lock the cradle to the trail at drill and in traveling to avoid unnecessary strain upon the pointing mechanism.

After unlimbering, release elevating and traversing lock before attempting to elevate or traverse gun.

Keep hub bolts and hub bands properly tightened.

To tighten the hub bands, screw them as tightly as possible with the wrench and then force them farther by striking the end of the wrench with a hammer.

Do not permit brake levers to be released by a kick or a blow.

Remove cylinder-end stud screw before trying to unscrew cylinder-end stud.

Replace and properly open all split pins after replacing nuts.

Close down the ends of the recoil-indicator guide to avoid loss of the indicator.

Prevent possible injury to cannoneers by causing them to stand clear of the counter-recoil-spring column in assembling or dismounting.

In moving the gun on or off the cradle, provide ample support for the breech end, so that the gun clips are in prolongation of the cradle guides; if this is not done, the cradle guides may be ruined.

If the gun will not remain at the elevation at which set, the crank shafts are probably not correctly assembled.

If the elevating screws do not house in traveling, they are incorrectly assembled.

Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

Frequently verify the adjustment of sights and quadrant.

Require special care in handling sights.

Do not permit cannoneers to use front sight as a handle in mounting.

Be sure that the range disk of the quadrant and range strip of the rear-sight shank are graduated for the particular type of ammunition used by the battery.

Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done, erratic shooting may result.

Battery commanders should frequently make a detailed inspection of all of the vehicles in the battery to see if any parts of them are broken and any nuts, screws, split pins, etc., missing. If any such defects are found, he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and compliance with these instructions will do much toward prolonging the life of the vehicles.

It has been found that the apron hinges occasionally become broken, and that the apron-hinge pins are frequently lost. When-



ever this happens the hinges or hinge pins should be immediately replaced, for if this is not done the apron, which is very expensive, is apt to become cracked or broken.

Whenever the lunettes become loosened the lunette nuts should at once be tightened up.

All wheels and pintle bearings should be frequently oiled.

All nuts are secured by split pins, which should be replaced and properly opened when nuts are screwed home.

All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes closed by spring covers or handy oilers.

See that fuzes are set at safety for transport.

Use the small primer-inserting press for inserting primers in cartridge cases and the decapping tools provided for removing old primers.

In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known, submit a sketch showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. The tables of nomenclature of parts have been arranged to show the parts included under the terms "one trail, complete; one wheel, complete," etc., and should be carefully studied before requisitions are made out, to insure that all parts wanted are included and duplications avoided. For example, if a piston rod is wanted the order should state whether it is to be with or without the nut. If all details are itemized it will avoid mistakes and unnecessary expense.

*Smokeless powder must not be used for blank charges.*

#### SUPPLIES IN GENERAL.

All bits, both curb and snaffle, are made of 27 per cent nickel steel, a practically noncorrosive metal.

The olive-drab saddle blanket is regulation for all arms of the service.

The supply of ammunition to be kept on hand in a 3-inch gun battery will be a sufficient amount to fill all the ammunition chests of the equipment, and in addition a sufficient number of rounds to cover the needs for annual target practice.

Pistol arm racks are issued for use of Field Artillery in such number as may be required to hold the pistols on hand in the battery. Each pistol arm rack holds 80 pistols.

Such articles as may be needed for training the horse—the cavesson, longing rein, running rein, etc.—may be readily made up by the



battery saddler from supplies furnished by the Ordnance Department.

For the training of enlisted men leather heads and wooden stands for supporting them will be needed. The saddler and the carpenter will be able to supply these by means of the tools in the forge limber and battery wagon.

A reloading and cleaning outfit for 3-inch guns for removing fired primers from and cleaning cartridge cases and for reloading blank ammunition is furnished to each battery.

#### **METHOD OF LOADING ONE 3-INCH GUN BATTERY FOR TRANSPORTATION BY RAIL.**

The flat cars usually obtained from railroad companies vary in length from 34 to 44 feet. Cars longer than 42 feet are unusual.

In loading a battery on cars during service operations it is very desirable to keep complete gun sections together as much as possible. Pursuing this idea, a 3-inch gun battery may be loaded as follows, when cars at least 34 feet long are obtained:

Four cars, each to contain:

- One 3-inch gun and carriage.
- Two 3-inch gun caissons.
- Three 3-inch gun limbers.

One car to contain:

- One battery wagon.
- One forge limber.
- Two 3-inch gun limbers.
- Two 3-inch gun caissons.

One car to contain:

- One store wagon.
- One store limber.
- Two 3-inch gun limbers.
- Two 3-inch gun caissons.

This car will be only about three-quarters filled if a 34-foot car is procured. The additional space may be utilized as the battery commander sees fit.

If cars less than 34 feet long are obtained, one limber or one caisson will have to be omitted. If cars 44 feet long are obtained, one additional limber or caisson can be loaded on each.

In loading the cars, if there is any permanent loading platform along the railroad tracks in the vicinity, the vehicles should be run onto these platforms and loaded from them. If there is no permanent platform in the vicinity, it will be necessary to build a temporary ramp. This should be built at the end of the cars. When loading vehicles from a permanent platform on the side of the cars it

may be necessary, if short cars are obtained, to remove the pole of the last limber placed on the car in order to get it onto the car. The pole should, however, be replaced in its socket as soon as the vehicle is placed in position.

When loading the cars, care must be exercised to load them so that there can be no movement of the vehicles on the cars longitudinally, transversely, or vertically. All wheels and trails of carriages, poles of limbers, lunettes of caissons and wagons must be secured to the bottom of the car. The vehicles are secured as follows:

2 by 4 inch timbers nailed to the floor of the cars on both sides of all the wheels hold the wheels securely against transverse motion.

2 by 4 inch chocks nailed to the 2 by 4 inch pieces which lie along the sides of the wheels hold the wheels against longitudinal motion on the cars.

2 by 4 inch timbers, placed over the felloes, resting on the floor between the two lowest spokes and bolted to the floor of the car with two  $\frac{1}{2}$ -inch bolts, hold the wheels against vertical motion. The bolts should preferably be bolted through these braces on the outside of the wheels. If bolts for bolting these 2 by 4 inch crosspieces can not be obtained, the crosspieces should be nailed down with 7 or 8 inch spikes. The poles and lunettes should be secured to the floor by nailing one 2 by 4 inch block on both sides of each and one 2 by 4 inch piece across the top near the end of the poles or lunettes.

The trails should be secured to the floor by nailing 2 by 4 inch blocks as follows:

- 1 on each side of the trail,
- 1 at the end of the trail in prolongation of the axis, and
- 1 across the top near the end.

All of the lumber used on the cars is 2 by 4 inch stock. To load a 3-inch gun battery will require 1,200 linear feet of 2 by 4 inch lumber.

For carrying all harness and all accessories of the vehicles which are not carried in compartments of these vehicles or rigidly attached to them, one box car should be obtained. The material in this box car should be packed in boxes if on hand. In case no box car can be obtained, all of the harness, etc., should be packed in boxes and placed on the flat cars near the vehicles. These boxes must be securely fastened to the floor to prevent them from falling off of the cars or from striking and injuring the vehicles.

## EQUIPMENT.

The following table shows the total equipment of one 3-inch gun battery on war footing. A place is designated for most of the articles, but the battery commander may use his discretion as to the disposition of many articles for which no particular fitting or receptacle is provided.

*Statement of total equipment of one 3-inch gun battery.*

War footing (4 guns, 12 caissons).	Articles.	Where carried.	Property classification.	
			Class.	Section.
4	Guns and gun carriages.....	.....	IV	3
12	Caissons.....	.....		
16	Limbers.....	.....		
1	Battery wagon.....	.....	IV	9
1	Forge limber.....	.....		
1	Store wagon.....	.....		
1	Store limber.....	.....		
1	2-horse reel.....	.....		
	<i>Tools and accessories for guns and carriages.</i>			
4	Axle seat cushions (left).....	On axle seat.....	IV	3
4	Axle seat cushions (right).....	do.....		
4	Breech covers.....	On gun.....		
8	Dust guards.....	On wheels.....		
4	Elevating-gear covers.....	On elevating mechanism.....		
4	Front-sight covers.....	On front sight.....		
4	Hand fuze setters.....	In cases.....		
4	Hand fuze setter cases.....	In trail box.....		
8	Lanyards.....	do.....		
4	Leather pouches for spare parts.....	do.....		
4	Lock washer holders.....	do.....		
4	Muzzle covers.....	On gun.....		
4	Oil-can boxes, horizontal oilers.....	In trail box.....		
4	Oilers, horizontal.....	In oil-can boxes.....		
4	Rear-sight bracket covers.....	On bracket on cradle.....		
4	Rear-sight shank covers.....	On sight in trail sight box.....		
4	Spanners for carriages.....	In trail box.....		
4	Spanners for 56-inch wheel.....	do.....		
4	Sponge covers.....	On sponge.....		
4	Sponges and rammers.....	In fastenings on trail.....		
4	Spools copper wire No. 20 (3 pounds each).....	In trail box.....		
4	Tool kits, canvas, each containing—			
	1 cold chisel, $\frac{3}{4}$ by 8 inches.....	.....		
	1 drift bronze, large.....	.....		
	1 drift bronze, small.....	.....		
	1 file, dead, smooth, 6 inches, 3 square.....	.....		
	1 file, hand, smooth, 8 inches, flat.....	.....		
	1 hammer, hand, cross-peen.....	do.....		
	1 pliers, wire cutting.....	.....		
	1 punch, steel, small.....	.....		
	1 screw driver, 10 inches.....	.....		
	1 screw-slot wrench.....	.....		
	1 wrench, filling and drain plugs.....	.....		
	1 wrench, range quadrant.....	.....		
4	Wrenches, $\frac{3}{4}$ and 1 inch.....	do.....		
4	Wrenches for assembling recoil springs and grindstone.....	do.....		



## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cali- sons).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	<i>Spare parts for guns and gun carriages.</i>			
4	Brake shoes.....	Carried in store wagon.....		
8	Brake-shoe tap bolts.....	do.....		
2	Hub liners.....	In battery wagon.....		
2	Lock washers.....	In miscellaneous spare parts chest...		
1	Lunette with nuts.....	In store wagon.....		
200	Split pins, assorted.....	Carried in leather pouches for spare parts.		
2	Wheels complete.....	On store wagon.....		
2	Wheel fastenings, complete.....	In battery wagon.....		
	<i>For gun if model of 1902.</i>			
1	Breech mechanism complete, including block carrier.....	In top rear compartment of battery wagon.		
4	Caps.....	In leather pouch for spare parts.....		
4	Cocking levers.....	do.....		
8	Cocking-lever pins.....	do.....		
8	Cover-locking pins.....	do.....		
8	Firing pins.....	do.....		
8	Firing-pin springs.....	do.....		
4	Hinge-pin catches.....	do.....		
4	Latch bolts.....	do.....		
4	Latch-bolt springs.....	do.....		
8	Oil-hole covers with screws.....	do.....		
4	Pivot keys.....	do.....		
4	Sears.....	do.....		
12	Sear springs.....	do.....		
4	Taper pin.....	do.....		
12	Trigger springs.....	do.....		
4	Lever-latch springs.....	do.....		
	<i>For guns if models of 1904 or 1905.</i>			
1	Breech mechanism complete, including block carrier.....	In top, rear compartment of battery wagon.		
4	Block latches.....			
4	Block-latch spring.....			
4	Firing pins.....			
4	Firing springs.....			
4	Firing-spring sleeves.....			
8	Handy oilers, $\frac{1}{4}$ inch (for 1905 gun only)...			
4	Hinge-pin catches.....			
4	Lever-latch springs.....	In leather pouch for spare parts.....		
4	Locking bolts, nuts, and pins.....			
4	Locking-bolt springs.....			
8	Oil-hole covers with screws (for 1904 gun only.)			
4	Pallet pins.....			
4	Sears.....			
8	Trigger-shaft detents.....			
	<i>For hand fuze setters if model of 1905 M.</i>			
2	Clamp shoe.....			
4	Corrector-scale screw.....			
6	Handle screw.....			
2	Index.....			
4	Plunger.....			
4	Plunger spring.....	In leather pouches for spare parts...		
4	Range-ring screw.....			
3	Stop pins.....			
4	Stop screw.....			
2	Wing nut.....			
2	0.062 by 0.47 inch steel pin.....			
	<i>For hand fuze setter if model of 1912.</i>			
6	Corrector-scale screw.....			
4	Guide-plate lock screw.....			
8	Index-bar screw.....			
4	Index plunger.....			
4	Index spring.....	In leather pouches for spare parts...		
8	Oil-hole screw.....			
4	Range index.....			
12	Range-ring screw.....			
3	Stop-pin screw.....			

## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	<i>For bracket fuze setter.</i>			
4	Corrector-scale screw .....	In leather pouches for spare parts ...		
12	Guide screw .....			
16	Housing screws and split washers .....			
4	Knob washer .....			
4	Range-worm crank and knob taper pin with brass split pin .....			
2	Range-worm crank handle .....			
8	Range-ring screw .....			
12	Split pins (0.125) .....			
4	Spring cover (No. 1) with screw .....			
4	Spring .....			
6	Stop pins with rivets .....			
	<i>For carriages.</i>			
1	Apron-latch, complete .....	In chest for miscellaneous spare parts		
2	Apron-latch springs .....	do.		
1	Apron-latch block with bolt and nut .....	do.		
1	Apron-latch pin .....	do.		
1	Brake lever with catch .....	Carried loose		
2	Brake-rod pins .....	In chest for miscellaneous spare parts		
1	Brake-rod spring .....	do.		
1	Brake-segment rack with rivets .....	do.		
3	Counter-recoil springs .....	do.		
	or			
	Counter-recoil springs:			
3	Inner .....	In store wagon		
3	Outer .....	do.		
4	Cylinder-end screw .....	In chest for miscellaneous spare parts		
1	Cylinder-end stud nut .....	do.		
2	Drain-plug cylinder .....	In leather pouch for spare parts		
2	Elevating and traversing lock springs .....	do.		
4	Elevating bevel pinion taper pins .....	In chest for miscellaneous spare parts		
1	Elevating pin .....	do.		
1	Elevating-screw cover with springs .....	do.		
2	Filling plugs (piston rod) .....	In leather pouch for spare parts		
	Firing mechanism, parts (for carriages Nos. 1 to 168, inclusive):		IV	3
1	Firing handle .....	In chest for miscellaneous spare parts		
2	Firing shafts .....	do.		
	Firing mechanism, parts (for carriages above No. 168):			
1	Adjusting screw with check nut .....	In chest for miscellaneous spare parts		
2	Bracket studs and nuts .....			
1	Firing handle .....			
1	Firing-handle bracket .....			
1	Firing-handle hub .....			
2	Firing-handle pins .....			
1	Firing-handle plug .....			
1	Firing-handle plunger .....			
4	Firing-handle springs .....			
1	Firing shaft .....			
2	Handle return springs .....			
2	Shaft return springs .....			
1	Shaft trip collar .....			
1	Trip-collar pin .....			
1	Trip latch .....			
1	Trip-latch pin .....			
1	Trip-latch plunger .....			
1	Trip-latch spring .....			
20	Garlock's waterproof packing, 1-inch rings .....	In leather pouch for spare parts		
	Handspikes, complete .....	In store wagon		
	Nuts, crown, special, set, consisting of—			
46	0.625 by 11 threads .....	Carried equally in leather pouches for spare parts.		
2	0.75 by 10 threads .....			
10	0.875 by 9 threads .....			
2	0.875 by 20 threads .....			
2	1.25 by 7 threads .....			
2	1.25 by 12 threads .....			
2	1.062 (1 $\frac{1}{8}$ ) by 16 threads .....			
	Nuts, crown, standard set, consisting of—			
18	0.375 by 16 threads .....			
12	0.5 by 13 threads .....			
28	0.625 by 11 threads .....			

## Statement of total equipment of one 8-inch gun battery—Continued.

War foot- ing (4 guns, 12 cali- sons).	Article.	Where carried.	Property classification.			
			Class.	Sec- tion.		
	<i>For carriages—Continued.</i>					
	Nuts, hexagon, special, set, consisting of—	Carried equally in leather pouches for spare parts.	IV	3		
2	0.187 ( $\frac{1}{4}$ ) by 26 F. A. standard threads.....					
2	0.242 by 24 threads.....					
2	0.375 by 16 threads.....					
	Nuts, hexagon, standard set, consisting of—					
2	0.19 by 30 threads.....					
1	Recoil indicator.....	In chest for miscellaneous spare parts				
4	Retaining ring hasp split pins and cords.....					
60	Rivets, assorted.....					
7	Spade-edge rivets.....					
12	Spring covers No. 1, with screws and washers.....					
1	Spade edge.....					
1	Sponge and rammer, complete.....					
1	Sponge cover.....					
2	Tube-cover latch springs.....					
1	Traversing-link pivot.....					
1	Traversing nut.....					
	<i>Tools and accessories for limbers.</i>					
16	Axes.....	On limber, under chest.....	IV	9		
48	Buckets, watering, canvas.....	On limber.....	IV	3		
32	Dust guards.....	On wheels.....				
16	Hatchets.....	On limber, in bracket, on left of chest.....	IV	4		
16	Lanterns.....	On limber, in bracket, front of chest.....				
16	Lantern-bracket pads.....	In brackets.....	IV	3		
16	Neck yokes.....	On pole.....	IV	3		
36	Oil cans, tubular.....	On limber in ammunition chest.....	IV	9		
16	Paulins 12 by 12 feet.....	On limber, on seat as cushion.....				
16	Pick axes.....	On limber, on foot rest.....				
16	Picket ropes.....	On limber, on front of chest.....				
16	Pole props.....	On limber in fastenings under frame.....				
16	Shovels, short handled.....	On limber under chest.....				
32	Singletrees.....	On doubletree.....				
	Straps:					
16	Ax.....	In fasteners.....	IV	3		
48	Grip.....					
16	Hatchet.....					
64	Limber-blanket, front.....					
64	Limber-blanket, rear.....					
48	Paulin.....					
16	Pick handle.....					
16	Pick head.....					
64	Picket rope, upper.....					
64	Picket rope, lower.....					
16	Pole prop.....					
16	Shovel handle.....					
	<i>Spare parts for limbers.</i>					
2	Ammunition-chest connection pins.....	In chest for miscellaneous spare parts	IV	3		
2	Ammunition-chest door lock hasps, bolts, and springs.....					
1	Ammunition-chest door lock spring.....					
2	Ammunition-chest shot bolts.....					
2	Doubletrees.....	In store wagon.....				
3	Doubletree bolts and nuts.....	In chest for miscellaneous spare parts				
2	Doubletree hooks.....	do.....				
3	Hub liners.....	In store wagon.....				
2	Hub cap complete.....	do.....				
3	Limber-prop chains, with handles.....	In chest for miscellaneous spare parts				
3	Lock washers.....	do.....				
8	Neck yokes, wooden.....	In store wagon.....				
2	Neck yokes, steel.....	do.....				
2	Oil cans, tubular.....	Carried loose.....				
4	Oil-can nozzles.....	do.....				
2	Padlocks, chains, clevises.....	In chest for miscellaneous spare parts				
2	Pintle-bearing bolts, with nuts.....					
1	Pintle, with bearing, complete.....					
2	Pintle-latch springs.....					
1	Pintle latches.....	Carried loose.....				
		Carried in chest for miscellaneous spare parts.....				
		Carried loose.....				



## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.			
			Class.	Section.		
	<i>Spare parts for limbers—Continued.</i>					
1	Pintle springs.....	Carried in chest for miscellaneous spare parts.	IV	3		
1	Picket rope.....	Carried loose.....				
4	Pole bodies, complete or.....	On caisson.....				
2	Poles, steel.....	do.....				
2	Pole covers.....	Carried loose.....				
2	Pole ferrules, complete.....	In store wagon.....				
8	Pole pads.....	In chest for miscellaneous spare parts.....				
2	Pole props.....	In store wagon.....				
4	Singletrees.....	do.....				
3	Wheels, complete.....	Where convenient.....				
3	Wheel fastenings, complete.....	In store wagon.....				
	<i>Tools and accessories for caisson.</i>					
12	Axes.....	On caisson, front of chest.....	IV	9		
24	Dust guards.....	On wheels.....	IV	3		
12	Fuze setters, bracket.....	On bracket.....				
12	Fuze setter-bracket covers.....	do.....	IV	9		
12	Paulins.....	On caisson, on seat as cushion.....				
12	Pick mattocks.....	On caisson, under chest.....				
12	Shovels, long-handled.....	do.....	IV	3		
12	Spanners, caisson.....	On caisson, on left of chest.....				
	Straps:					
12	Ax.....	In fasteners.....				
36	Grip.....					
36	Paulin.....					
12	Pick-mattock.....					
12	Shovel-handle.....					
12	Spanner.....					
12	Wrench.....					
12	Wrenches, 0.625 and 0.75 inch.....	On caisson, on left of chest.....				
	<i>Spare parts for caissons.</i>					
2	Apron hinges, complete, end.....	In chest for miscellaneous spare parts.....	V	3		
2	Apron hinges, complete, center.....					
4	Apron-hinge pins.....					
1	Apron latch, complete.....					
2	Apron-latch springs.....	In store wagon.....				
2	Brake-levers, with catches.....					
12	Brake shoes.....	do.....				
24	Brake-shoe tap bolts.....	do.....				
1	Caisson-prop chain and hook.....	do.....				
1	Caisson prop, with chain and hook.....	do.....				
3	Hub liners.....	do.....	IV	3		
3	Lock washers.....	In chest for miscellaneous spare parts.....				
1	Lunette, with nut.....	In store wagon.....				
2	Padlocks, chains, and clevises.....	do.....				
2	Pintle-bearing bolts, with nuts.....	do.....				
1	Pintle, with bearing, complete.....	do.....				
1	Pintle latch.....	do.....				
2	Pintle-latch springs.....	do.....				
1	Pintle spring.....	do.....				
300	Split pins.....	Pouches for spare parts.....				
3	Wheels, complete.....	Where convenient.....	IV	3		
3	Wheel fastenings, complete.....	In store wagon.....				
	<i>Tools and accessories for battery wagon.</i>					
1	Carpenters' chest, with tools, set.....	In battery wagon.....	IV	9		
1	Chest for cleaning material and small stores.....	do.....				
1	Chest for spare breech mechanism.....	do.....				
1	Chest for spare sights, containing—	In battery wagon.....	IV	3		
	1 bore sight, breech.....					
	1 bore sight, muzzle.....					
1	Double tackle block.....	do.....	IV	9		
2	Dust guards.....	On wheels.....	IV	3		
1	Forge coal bag.....	On battery wagon.....	IV	9		
1	Filling funnel, cylinder.....	In battery wagon.....	IV	3		
1	Grindstone with frame, complete.....	do.....	IV	9		
1	Jackscrew.....	do.....	IV	9		
1	Marking outfit for stamping leather.....	In cleaning-material and small-stores chest.....	X	5		
1	Marking outfit for stamping metal.....	do.....				

## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.	
			Class.	Section.
	<i>Tools and accessories for battery wagon—Con.</i>			
3	Oil cans, 5-gallon.....	In oil-can supports.....	IV	9
1	Ordnance Department insignia stencil.....	In cleaning-material and small-stores chest.....	X	5
1	Packing chest for supplies.....	In battery wagon.....	IV	3
1	Packing chest for spare parts.....	do.....		
1	Paulin.....	On battery wagon.....	IV	9
1	Rope, 70 feet long.....	In battery wagon.....		
1	Saddler's chest, with tools, set.....	do.....	X	9
1	Seal stamp.....	In cleaning-material and small-stores chest.....	X	5
1	Single-tackle block.....	In battery wagon.....	IV	9
2	Spare wheel-hub covers.....	On spare wheels.....	IV	3
2	Spring centering tools.....	In battery wagon.....	X	9
2	Spring compressors No. 1.....	do.....	X	9
1	Stencil outfit.....	In cleaning-material and small-stores chest.....	X	5
	<i>Straps:</i>			
2	Grip.....	In strap fasteners.....	IV	3
2	Jackscrew.....	do.....		
2	Paulin.....	do.....	IV	9
1	Testing level and chest.....	In battery wagon.....		
1	Vise.....	Attached to lunette frame.....	X	9
2	Water buckets, galvanized steel.....	In battery wagon.....	IV	9
1	Wrench, grindstone and recoil-spring assembling.....	do.....	IV	3
	<i>Tools and accessories for store wagon.</i>			
20	Bolos.....	In store wagon.....	VII	5
20	Bolo scabbards.....	do.....		
1	Chest for miscellaneous spare parts.....	do.....	IV	3
1	Crowbar.....	On store wagon under body.....		
2	Dust guards.....	On wheels.....	IV	9
1	Filling funnel, cylinder.....	In store wagon.....		
3	Oil cans, 5-gallon.....	On store wagon in oil-can supports.....	IV	9
1	Paulin, 12 by 12 feet.....	do.....		
1	Slush brush.....	do.....	IV	3
	<i>Straps:</i>			
1	Crowbar.....	In strap fasteners.....	IV	3
2	Grip.....			
2	Paulin.....	In store wagon.....	IV	3
2	Spare wheel-hub covers.....			
	<i>Tools and accessories for forge limber.</i>			
1	Ax.....	On limber, under chest.....	IV	9
3	Buckets, watering, canvas.....	On limber, in bucket holder.....		
2	Dust guards.....	On wheels.....	IV	3
1	Hatchet.....	In bracket on left of chest.....	IV	9
1	Hub liner driving tool.....	In forge limber.....	IV	3
1	Lantern.....	On limber, in bracket on front of chest.....	IV	9
1	Lantern-bracket pad.....	In lantern bracket.....	IV	3
1	Neck yoke.....	On pole.....		
2	Oil cans, tubular.....	On limber, in supports under chest.....	IV	9
1	Paulin, 12 by 12 feet.....	On limber chest as cushion.....		
1	Pickax.....	On limber foot rest.....	IV	9
1	Picket rope.....	On limber, in front of chest.....		
1	Pole prop.....	On limber, in fastenings under frame.....	IV	3
1	Shovel, short-handled.....	On limber, under chest.....	IV	9
2	Single trees.....	Attached to double tree.....	IV	3
	<i>Straps:</i>			
1	Ax.....	In strap fasteners.....		
3	Grip.....			
1	Hatchet.....			
4	Limber blanket, front.....			
4	Limber blanket, rear.....			
3	Paulin.....			
1	Pick handle.....			
1	Pick head.....			
4	Picket rope, upper.....			
4	Picket rope, lower.....			
1	Pole prop.....			
1	Shovel handle.....			
1	Sledge.....	In fastener.....		

1 2 for horse batteries.

## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	<i>Tools and accessories for store limber.</i>			
1	Ax.....	On limber, under chest.....	IV	
3	Buckets, watering, canvas.....	In bucket holder.....		
1	Cyclometer for 56-inch wheel.....	On axle of limber.....	IV	3
2	Dust guards.....	On wheels.....		
1	Hatchet.....	On limber in bracket.....	IV	9
1	Lantern.....	On limber in bracket on chest front.....		
1	Lantern-bracket pad.....	In brackets.....	IV	[3
1	Neck yoke.....	On pole.....		
2	Oil cans, tubular.....	On limber, in supports.....	IV	[9
1	Paulin, 12 by 12 feet.....	On limber chest as cushion.....		
1	Pick ax.....	On limber foot rest.....	IV	[3
1	Picket rope.....	On limber, in front of chest.....		
1	Pole prop.....	In fastening under frame.....	IV	9
1	Shovel, short handled.....	On limber under chest.....		
2	Singletrees.....	Attached to doubletrees.....		
	<i>Straps:</i>			
1	Ax.....	In strap fasteners.....	IV	3
3	Grip.....			
1	Hatchet.....			
4	Limber blanket, front.....			
4	Limber blanket, rear.....			
3	Paulin.....			
1	Pick handle.....			
1	Pick head.....			
4	Picket rope, upper.....			
4	Picket rope, lower.....			
1	Pole prop.....			
1	Shovel, handle.....			
	<i>Spare parts of accessories.</i>			
4	Ax helvies.....	In store wagon.....	IV	9
2	Handles, shovel, long.....	do.....		
3	Handles, shovel, short.....	do.....		
4	Handles, hatchet.....	do.....		
4	Handles, pick ax.....	do.....		
3	Padlocks, with chain clevises and bolt snaps.....	In battery wagon.....		
	<i>Sights and quadrants.</i>			
4	Front sights.....	In bracket.....	IV	3
4	Front-sight brackets, with holders.....	In fastenings on cradle.....		
4	Rear-sight brackets, with shank sockets.....	In bracket.....		
4	Rear-sight shanks.....	In fastenings on cradle.....		
4	Panoramic sights.....	In case on shield.....		
4	Range quadrants.....	In case on right side of trail.....		
4	Teat wrenches for panoramic sights.....	In case on shield.....		
	<i>Spare sights and quadrants.</i>			
1	Front sight, complete.....	In spare-sights chest in battery wagon.....	IV	3
1	Rear sight, complete.....			
1	Panoramic sight.....			
1	Range quadrant.....			
1	Teat wrench for panoramic sight.....			
	<i>Range-finding and fire-control equipment.<sup>2</sup></i>			
8 1	Aiming circle.....	On pack horse.....		
8 1	Aiming-circle case.....			
8 1	Aiming-circle tripod.....			
8 1	Aiming-circle tripod case.....			
10	Battery commander's ruler, wooden.....	On person or in store limber.....	V	
2	Battery commander's telescopes and mounts, model of 1915.....			
2	Battery commander's telescope cases.....			
	Accessories carried in case:			
	1 camel's-hair brush.....	1 on pack horse.....		
	1 pin wrench.....	1 in store limber.....		
	1 screw driver.....			
	1 teat wrench.....			
2	Battery commander's telescope tripods.....			
2	Battery commander's telescope tripod cases.....			

<sup>1</sup> 2 for horse batteries.<sup>2</sup> For description of fire-control equipment see O. O. Form 1796.<sup>3</sup> Will be issued when available.<sup>4</sup> Metal B. C. rulers with cases are no longer part of the equipment. Those on hand may be retained.



## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.			
			Class.	Sec- tion.		
	<i>Range-finding and fire-control equipment— Continued.</i>					
2	Chains for time-interval recorder.....	In store limber.....	V			
5	Flash lights with hoods.....					
16	Flash lights without hoods.....					
1	Map and plotting board.....	Where convenient.....				
1	Observation tower.....	On caisson in the fifth section.....				
2	Prismatic compasses.....	Where convenient.....				
6	Protractors, xylonite, rectangular.....					
1	Ruler for solution of triangles.....					
1	Range finder, 1-meter base.....	On pack horse.....				
1	Range-finder case.....					
1	Range-finder tripod.....					
1	Range-finder tripod case.....	On caisson chest.....				
1	Reel for caisson.....					
1	Tape, steel, 100 feet.....	In store limber.....				
2	Time-interval recorders.....					
	(Furnished by Signal Corps <sup>2</sup> ).....					
	<i>Harness.</i>					
37	Harness, lead, sets.....	On horses.....	IV			
19	Harness, wheel, sets.....					
56	Harness sacks.....	Not carried in field.....				
1	Pack harness special pack equipment <sup>4</sup> .....	On pack horse.....				
	<i>Spare parts of Artillery harness.</i>					
6	Breast straps.....	In battery wagon.....	IV	8		
1	Bridle, Artillery, off.....	do.....				
1	Bridle, Artillery, near.....	do.....				
12	Cinchas, lead.....	do.....				
6	Cinchas, wheel.....	do.....				
5	Collar pads, canvas.....	Not part of harness.....				
8	Collar straps.....	do.....	IX	5		
20	Curb bits.....	do.....				
20	Curb chains, with hooks.....	do.....				
8	Feed bags.....	In battery wagon.....				
8	Grain bags.....	do.....				
6	Halter headstalls.....	do.....				
20	Halter tie ropes.....	do.....	IV	8		
6	Martingales with cincha strap.....	do.....				
4	Mogul springs, 320 pounds.....	do.....				
6	Side straps for breeching.....	do.....				
4	Steel collars, with 2 hame tugs each.....	do.....				
12	Stirrup straps.....	do.....				
8	Traces, lead, with chain.....	do.....				
4	Traces, wheel.....	do.....				
4	Whips, Artillery.....	do.....				
	<i>Spare parts of steel collars.</i>					
6	Bolts for bottom of collar.....	In miscellaneous spare-parts chest, store wagon.	IV	8		
6	Bolts for extension.....					
6	Bolts for top connection.....					
6	Bolts for trace plate.....					
2	Buckle latches.....	Carried loose.....				
6	Buckle springs.....	In miscellaneous spare-parts chest, store wagon.				
4	Draft springs.....	Carried loose.....				
6	Pad bolts.....					
6	Pad hooks, with collar back strap con- nection.....					
6	Nuts for bottom bolt.....	In miscellaneous spare-parts chest, store wagon.				
6	Nuts for extension bolt.....					
6	Nuts for top connection bolt.....					
6	Nuts for pad bolt.....					
6	Nuts for trace plate bolt.....					
2	Trace plate and loops.....					
6	Washers for trace plate bolt.....					

<sup>1</sup> Field Artillery range finders will be issued as soon as a supply is available. When issued, the sextant telemeter now on hand in some of the organizations will be turned in.

<sup>2</sup> For list of these parts see Unit Accountability Equipment Manual.

<sup>3</sup> 1 set is spare.

<sup>4</sup> This set of pack harness and special pack equipment will be issued to carry the fire-control equipment until the reel, 2 horse, is available.

## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	<i>Spare parts of breast collar harness.</i>			
2	Bridles and bits, artillery.....	In battery wagon.....		
12	Cinchas, artillery, lead.....			
8	Feed bags.....			
8	Grain bags.....			
6	Halter headstalls.....			
20	Halter tie ropes, model of 1912.....			
6	Martingales, with cincha straps.....			
4	Mogul springs.....			
6	Side straps for breeching.....			
12	Stirrup straps.....			
8	Traces, lead, with chains.....			
4	Traces, wheel.....			
4	Whips, artillery.....	In store wagon.		
4	Breast collar with neck straps.....			
2	Neck-yoke neck straps.....			
4	Choke straps.....			
2	Collar pads.....			
2	Pad strap buckle pieces.....			
6	Cinchas, artillery, wheel.....			
2	Back strap hook.....			
6	Barrel roller buckles, 1.25 inches.....			
2	Double eye loop.....			
2	Snap hook, convert's 2-inch.....			
	<i>Instruction equipment.</i>			
1	Sectionalized shell.....	Not carried in field.....	V	4
1	Sectionalized shrapnel.....			
	<i>Miscellaneous equipment.</i>			
1	Reloading and cleaning outfit consisting of—	In chest for reloading and cleaning outfit in store wagon.		
	1 bushing.....			
	1 cleaning brush (16.75 inches long).....			
	1 case holder.....			
	1 case-holder stand.....			
	1 decapping tool (17.9 inches long).....			
	1 hammer.....			
	1 primer-inserting press, small.....			
	1 saluting powder measure.....			
	1 storage chest.....			
4	Subcaliber and drill cartridge kit, con- sisting of—	In store.....	V	5
	3 drill cartridges, 1 extra base.....			
	1 subcaliber cartridge.....			
	1 bristle cleaning brush.....			
	1 cleaning rod.....			
	2 closing cap set screws.....			
	1 extension piece.....			
	2 extractor springs.....			
	2 extractor-spring screws.....			
	1 eyepiece.....			
	1 graduated ring with felt washer.....			
	4 ring screws.....			
	6 rotating pins.....			
	6 stop pins.....			
	1 storage chest.....			
	1 wrench, pin.....			
1	Pistol-cleaning kit.....	Where convenient.....	X	9
2	Arm racks for automatic pistols..... (For targets, see O. O. Pamphlet No. 1994.)		X	1
	<i>Ammunition.</i>			
1432	Shrapnel, H. E., rounds, or.....	In ammunition chests.....	V	4
859	Shrapnel, rounds, and.....			
573	Shell, rounds.....			

## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cali- s- sons).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	<i>Personal equipment.</i>			
	See Unit Accountability Manual.			
	<i>Horse equipment for each horse.</i>			
	See U. E. A. M.			
	<i>Saddler's tools.</i>			
12	Awl blades, harness, assorted.....	In saddler's chest in battery wagon..	X	9
1	Awl, pegging.....			
1	Awl, seat, handled.....			
1	Carriage, pricking, 3 wheels.....			
1	Compass, 6 inches.....			
1	Creaser, double, lignum vitæ.....			
1	Claw tool.....			
1	Edge tool No. 1.....			
1	Edge tool No. 2.....			
2	Extra blades, with followers, for draw gage.			
1	Gage, draw, brass.....			
2	Halts, patent, awl, rosewood.....			
1	Hammer, No. 3, riveting.....			
1	Handle, peg, awl, with wrench.....			
1	Knife, round.....			
1	Knife, splitting, 6-inch.....			
1	Needle case, leather.....			
1	Needle, glovers' No. 3, paper.....			
2	Needles, harness No. 4, papers.....			
2	Needles, harness No. 5, papers.....			
2	Needles, harness No. 6, papers.....			
12	Needles, sacking, assorted.....			
1	Nipper, cutting, 10-inch.....			
1	Oilstone, unmounted.....			
1	Pliers, 6-inch.....			
4	Punches, hand, round, assorted.....			
1	Punch, revolving.....			
1	Rivet sets.....			
1	Rule, boxwood, 2-foot, 4 fold.....			
1	Screw drivers, 3-inch blade.....			
1	Sewing palm, leather.....			
1	Shears, 10-inch bent trimmers.....			
1	Shoe knife, square point.....			
1	Shoe knife, broad point.....			
1	Slicker, steel.....			
2	Thimbles.....			
	<i>Carpenter tools.</i>			
1	Bench ax.....	In carpenter's chest in battery wagon		
2	Bags, canvas, for small stores.....			
1	Bevel, 8-inch.....			
6	Bits, auger.....			
1	Bit, wood countersink.....			
1	Bit, expansive, 2 cutters.....			
3	Bits, screw driver.....			
1	Brace, ratchet, 10-inch sweep.....			
3	Chisels, socket, framing.....			
1	Dividers, wing, 10-inch.....			
4	Drills, twist.....			
1	File, 10-inch, flat, bastard.....			
6	Files, saw, 4 and 6 inch (3 of each).....			
1	Gage, marking, brass, thumbscrew shoe and face.....			
2	Gouges, socket firmer.....			
1	Hammer, claw, adze eye.....			
1	Handle, tool, containing 10 tools.....			
2	Handles, file, aluminum alloy.....			
1	Knife, drawing, 9-inch blade.....			
1	Mallet, 2½ by 5 inches, maple, hickory handled.....			
1	Nail set.....			
1	Oiler.....			
1	Oilstone, unmounted.....			
1	Pincer, small, 8-inch.....			
1	Plane, jack, wood.....			
1	Plane, smoothing, wood.....			
1	Plate, auger handle.....			
1	Rasp, wood, 10-inch.....			
1	Reamer, half round, for wood or soft metal.			
1	Rule, boxwood, 2-foot, 4 fold.....			



## Statement of total equipment of one 3-inch gun battery—Continued.

War foot- ing (4 guns, 12 cais- sons).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
	<i>Carpenter tools—Continued.</i>			
1	Saw, crosscut, 24-inch.....	In carpenter's chest in battery wagon		
1	Saw, rip, 24-inch.....			
1	Saw set.....			
1	Screw driver, 5-inch blade, 10-inch.....			
1	Spokeshave, adjustable.....			
1	Square, steel, 12-inch body, 8-inch tongue.....			
1	Tape line, linen.....			
1	Vise, table, 2½-inch.....			
1	Wrench, screw, 12-inch.....			
	<i>Blacksmith's tools.</i>			
1	Anvil, 100-pound.....	In forge limber chest.....		
2	Aprons, blacksmith's.....			
2	Bags, canvas, for nails.....			
1	Box, shoeing, leather.....			
1	Chisel, cold, 8-inch.....			
1	Chisel, handled, for cold iron, 2 pounds.....			
1	Chisel, handled, for hot iron, 1.5 pounds.....			
1	Clinching iron.....			
1	File, flat, 12-inch, bastard.....	In forge limber chest.....	X	9
1	Fire rake.....			
1	Fire shovel.....			
1	Flatter, handled, 1.5-inch, square face.....			
1	Fore punch and crease.....			
1	Forge, Empire, portable.....			
1	Hammer, hand, 2 pounds.....			
1	Hammer, riveting, 1 pound 2 ounces.....			
1	Hammer, shoeing, 10 ounces.....			
1	Handle, file aluminum.....			
1	Hardie, 0.75 square shank, 1.25 bit.....			
1	Cutting nippers, 14-inch.....			
1	Oiler.....			
1	Pritchel, 0.75 flats, 9-inch.....			
1	Punch, round, 0.375-inch.....			
1	Punch, round, 0.312 ½-inch.....			
1	Punch, nail.....			
1	Punch, square.....			
5	Rivet sets, 5 sizes.....			
1	Rule, boxwood, 2-foot, 4-fold.....			
1	Screw plates, taps and dies, with tap wrench, including chest.....			
2	Shoeing knives.....			
1	Shoeing pincers.....			
1	Shoeing rasp, 16-inch.....			
1	Sledge, 11-pound.....			
1	Square.....			
1	Toe knife.....			
1	Tongs, horseshoer's.....			
1	Tongs for 0.25 iron.....			
1	Tongs for 0.5 iron.....			
1	Whetstone, farriers', 10-inch.....			
1	Wrench, forge.....			
1	Wrench, screw, 12-inch.....			
1	Vise.....			

Horse bat- tery.	Light bat- tery.	Article.	Where carried.	Property classification.	
				Class.	Sec- tion.
		<i>Materials for cleaning and preservation (6 months' supply, all expendable).</i>			
5	5	Borax, pounds, lump.....	In store wagon.....	X	10
1	1	Black adhesive tape, ¾ inch wide, ½-pound roll.....	do.....		
1	1	Brush, camel's hair, No. 1, round.....	In chest for cleaning material and small stores.....		
3	3	Brushes, sash, No. 3.....	do.....		
3	3	Brushes, sash, No. 5.....	do.....		

## Statement of total equipment of one 3-inch gun battery—Continued.

Horse battery.	Light battery.	Article.	Where carried.	Property classification.	
				Class.	Section.
		<i>Materials for cleaning and preservation (6 months' supply, all expendable)—Con.</i>			
1	1	Brush, varnish, No. 4-0.....	In store wagon.....		
2	2	Brushes, varnish, No. 5-0.....	do.....		
2	2	Brushes, varnish, No. 6-0.....	do.....		
2	2	Burners, lantern, Dietz, Vesta.....	In chest for cleaning material and small stores.		
2	2	Cloth, crocus, quires.....	1 quire in cleaning-material chest; the rest in store.		
1	1	Cloth, emery, No. $\frac{1}{2}$ , quire.....	In chest for cleaning material and small stores.		
1	1	Cloth, emery, No. 0, quire.....	do.....		
1	1	Cloth, emery, No. 00, quire.....	do.....		
2	2	Cosmic, No. 80, soft, quarts (1 quart cans)	In store wagon.....		
2	2	Chamois skins.....	In chest for cleaning material and small stores.		
4	3	Dressing, russet leather, boxes.....	do.....		
21	21	Eveready tungsten battery No. 793.....	In store wagon.....		
6	6	Eveready 2.7 V. Mazda bulb No. 1197.....	do.....		
2	2	Globes, lantern.....	In chest for cleaning material and small stores.		
17	7	Lavaline, 16-ounce cans.....	In store wagon.....		
25	25	Lye, powdered, cans, 1-pound.....	5 pounds in store wagon; rest in store.		
20	15	Naphthaline, pounds.....	Not carried in field.....		
1	1	Oil, clock, ounce, 1-ounce bottle.....	In cleaning-material and small-stores chest.		
5	5	Oil, hydroline, gallons, 5-gallon cans....	In cans on store limber.....		
6	6	Oil, linseed, boiled, gallons.....	1 gallon in store wagon, rest to be retained in store at post.		
1	1	Oil, linseed, raw, pints.....	In cleaning-material and small-stores chest.		
15	15	Oil, lubricating, gallons.....	In oil cans on battery and store wagons.		
20	20	Oil, neat's-foot, gallons.....	4 gallons in store wagon, rest to be retained in store at post.	X	10
5	5	Oil, slushing, light, gallons.....	2 gallons in store wagon, rest to be retained in store at post.		
5	5	Oil, coal, gallons.....	In oil cans under battery and store wagons.		
2	2	Oil, sperm, gallons.....	do.....		
75	75	Paint, olive drab, second coat, pounds....	5 pounds in store wagon, rest to be retained in store at post.		
75	75	Paint, olive drab, third coat, pounds....	do.....		
5	5	Paint, rubberine, gallons (1 gallon cans).	Not carried in field.....		
5 $\frac{1}{2}$	5 $\frac{1}{2}$	Petrolatum (vaseline), ounces (in tin box).	In cleaning-material and small-stores chest.		
17	7	Polish, Gibson's soap, 16-ounce cans.....	In store wagon.....		
6	6	Primer, brown enamel, quarts.....	In store at post.....		
75	75	Sal soda, pounds, bulk.....	20 pounds in chest for cleaning material, rest to be retained in store at post.		
1	1	Sandpaper, No. 2 $\frac{1}{2}$ , quires.....	In cleaning-material and small-stores chest.		
1	1	Sandpaper, No. 1 $\frac{1}{2}$ , quires.....	do.....		
1	1	Sandpaper, No. $\frac{1}{2}$ , quires.....	do.....		
1	1	Sandpaper, No. 00, quires.....	do.....		
72	52	Soap, castile, pounds.....	In store wagon.....		
6	4	Soap, H and H, cakes or Paco.....	do.....		
100	80	Soap, saddle, Frank Miller's, pounds (1-pound tins).	do.....		
100	65	Sponges, 5-inch.....	25 in store wagon, rest to be retained in store at post.		
10	10	Sponges, large size, 5 $\frac{1}{2}$ or 6 inch.....	In store wagon.....		
8	8	Turpentine, gallons.....	$\frac{1}{2}$ gallon in store wagon, rest to be retained in store at post.		
40	40	Waste, cotton, pounds, white.....	10 pounds in store wagon, rest to be retained in store at post.		
5	5	Wicks, lantern, size 0.....	In cleaning-material and small-stores chest.		
		<i>Saddler's material (6 months' supply, all expendable)</i>			
6	6	Awl blades, harness, assorted.....	In saddler's chest.....	X	9
1	1	Awl hawks, patent, No. 146, with wrench.			

<sup>1</sup> Only one of these items will be issued to an organization.

## Statement of total equipment of one 3-inch gun battery—Continued.

Horse battery.	Light battery.	Article.	Where carried.	Property classification.	
				Class.	Section.
		<i>Saddler's material (6 months' supply, all expendable)—Continued.</i>			
3	2	Buckles, bar, 1-inch Saalbach, bronze...	In miscellaneous spare-parts chest, in battery wagon.	X	10
8	8	Buckles, bar, tongueless, $\frac{3}{4}$ -inch, brass...			
21	13	Buckles, bar, tongueless, 1-inch, brass...			
6	5	Buckles, bar, tongueless, $\frac{1}{2}$ -inch, brass...			
40	30	Buckles, centerbar, $\frac{3}{4}$ -inch, bronze.....			
12	6	Buckles, centerbar, $\frac{3}{4}$ -inch, bronze.....			
12	9	Buckles, centerbar, $\frac{3}{4}$ -inch, bronze.....			
3	2	Buckles, centerbar, 1-inch, bronze.....			
12	10	Buckles, centerbar, $\frac{1}{2}$ -inch, bronze.....			
12	10	Buckles, centerbar, $\frac{1}{2}$ -inch, bronze.....			
8	7	Buckles, roller, $\frac{3}{4}$ -inch, bronze.....			
2	2	Buckles, roller, $\frac{3}{4}$ -inch, bronze.....			
15	15	Buckles, roller, $\frac{3}{4}$ -inch, bronze.....			
4	4	Buckles, roller, 1-inch, bronze.....			
50	46	Buckles, roller, $\frac{1}{2}$ -inch, bronze.....			
3	3	Buckles, roller, $\frac{1}{2}$ -inch, bronze.....	In miscellaneous spare-parts chest, in battery wagon.	IX	5
6	6	Buckles, satchel, $\frac{1}{2}$ -inch, bronze.....			
6	3	Buckles, wire, $\frac{1}{2}$ -inch, brass.....			
3	1	Buckles, wire, $\frac{3}{4}$ -inch.....			
36	24	Buckles, wire, $\frac{1}{2}$ -inch, brass.....			
6	3	Cheek "D," bronze.....			
11	11	Conway loop, $\frac{1}{2}$ -inch, bronze.....			
25	20	Duck, cotton, olive drab, 22-inch, No. 1...			
12	12	End buckle, 1-inch, bronze, with clip...			
25	22	End clip, $\frac{3}{4}$ -inch, brass.....			
30	12	End clip, 1-inch, brass.....			
30	21	End clip, $\frac{1}{2}$ -inch, brass.....			
12	9	Foot staples, high, bronze.....			
24	18	Foot staples, low, bronze.....			
12	9	Foot staples, semicircular, bronze.....			
8	8	Hooks, back strap, M. I.....	In miscellaneous spare-parts chest, in battery wagon.	IV	8
2	2	Hooks, breast strap, M. I.....			
6	10	Hooks, end, double (brass wire).....			
9	12	Hooks, end, single (brass wire).....			
2	2	Hooks, side strap, wheel.....			
6	4	Leathers, bridle, sides.....			
6	5	Leathers, collar, backs.....			
160	150	Leathers, harness, backs, pounds.....			
1	1	Leathers, latigo, sides.....			
10	8	Nails, saddle.....			
1	1	Needles, Glovers, No. 3, papers.....			
1	1	Needles, harness, No. 4, papers.....			
1	1	Needles, harness, No. 5, papers.....			
1	1	Needles, harness, No. 6, papers.....			
10	8	Ornaments, brow band, copper.....			
10	8	Ovals, saddle.....			
5	3	Ovals, saddle bag.....			
1	1	Pins, screw, brass, $\frac{1}{2}$ -inch, No. 2, 1 gross packages.....			
14	10	Rings, $\frac{1}{2}$ -inch diameter (rifle scabbard).....	In miscellaneous spare-parts chest, in battery wagon.	IX	5
24	18	Rings, $\frac{1}{2}$ inches diameter (saddle).....			
3	3	Rings, $\frac{1}{2}$ inches diameter (back strap).....			
9	8	Rings, $\frac{1}{2}$ inches diameter (breaching and throat strap).....			
12	10	Rings, 2 inches diameter (halter).....			
12	6	Rings, 4 inches diameter (chinch and quarter strap).....			
8	8	Rings D, 0.85 by 1 inch (feed bag), M. I.			
6	6	Rings D, $\frac{1}{2}$ inches by $\frac{3}{4}$ inch, with clasp, steel.			
3	3	Rings D, $\frac{1}{2}$ inches by 1 inch (with roller).....			
3	3	Rings D, 1.69 by 2 inches (with roller).....			
1	1	Rivets and burrs, brass, $\frac{3}{4}$ -inch, No. 12, pounds.			
1	1	Rivets and burrs, brass, $\frac{1}{2}$ -inch, No. 10, pounds.			
1	1	Rivets and burrs, brass, $\frac{3}{8}$ -inch, No. 10, pounds.			
1	1	Rivets and burrs, brass, 1-inch, No. 8, oval heads, pounds.			
3	3	Rollers, lead rein steel.....			
1,600	1,260	Rope, $\frac{1}{2}$ -inch (halter), feet, manila hemp.			
1	1	Screws, brass, 1-inch, No. 6, wood, gross.	In battery wagon.....	X	10
15	10	Sheep skins with wool on.....			



## Statement of total equipment of one 3-inch gun battery—Continued.

Horse battery.	Light battery.	Article.	Where carried.	Property classification.	
				Class.	Section.
		<i>Saddler's material (6 months' supply, all expendable)—Continued.</i>			
2	1	Shields, saddle, 11-inch .....	In miscellaneous spare-parts chest, in battery wagon.	IX	5
2	1	Shields, saddle, 11½-inch .....			
4	3	Shields, saddle, 12-inch .....			
5	3	Snap hooks, canteen, Cavalry .....			
2	2	Snap hooks, converts, ¾-inch, M. I. ....			
2	2	Snap hooks, converts, 1-inch, M. I. ....		X	10
3	2	Snap hooks, German, ¾-inch, M. I. ....			
3	5	Snap hooks, sack, 1-inch .....		IX	1
6	5	Snap hooks, swivel, 1-inch, No. 16 .....			
8	8	Snap hooks, German, 1-inch, M. I. ....		X	10
36	28	Squares, halter, bronze .....	In saddler's chest .....	IX	5
2	2	Strap loops, coupling, ¾-inch (for bridle) ..			
8	8	Strap loops, feed bags .....			
3	3	Stud hooks .....			
6	5	Studs, saddle bag .....			
1	1	Tacks, copper, No. 12, ¼ lb., paper .....		In miscellaneous spare-parts chest, in battery wagon.	
1	1	Tacks, copper, No. 20, ½ lb., paper .....			
1	1	Thimble, aluminum lined, steel, size ½ inch.			
1	1	Thread, carpet, No. 18, olive-drab, pound.			
2	1	Thread, shoe, No. 3, brown, pounds .....			
2	1	Thread, shoe, No. 10, brown, pounds .....			
2	2	Wax, stitching, brown, winter, pounds .....			
20	16	Webbing, olive-drab, cotton, heavy, ¾-inch, yards.	In battery wagon .....		
35	28	Webbing, olive-drab, cotton, heavy, 1-inch, yards.			
15	11	Webbing, olive-drab, halter, 1½-inch, yards.			
20	14	Webbing, jute, ¾-inch, yards .....			
		<i>For polo equipment.</i>		X	10
2	2	Buckles, wire, ¾-inch .....	In saddler's chest .....		
2	2	Buckles, wire, ¾-inch .....			
12	12	Buckles, wire, ¾-inch .....			
4	4	Buckles, wire, ¾-inch .....			
2	2	Buckles, nickel plated, stirrup strap, 1½-inch.			
6	6	Buckle, nickel plated, girth, 1-inch .....	In battery wagon .....		
4	4	Ring, ¾-inch diameter .....			
5	5	Web, linen straining, ¾-inch, yards .....			
7	7	Web, linen straining, 5-inch, yards .....			

No.	Article.	Where carried.	Property classification.	
			Class.	Section.
	<i>Reserve supplies for war service.<sup>1</sup></i>			
3	Buckles, bar, tongueless, ¾-inch .....	In store .....	X	10
5	Buckles, bar, tongueless, 1-inch .....			
10	Buckles, center bar, ¾-inch .....			
3	Buckles, center bar, ¾-inch .....			
3	Buckles, center bar, ¾-inch .....			
3	Buckles, center bar, 1½-inch .....			
3	Buckles, center bar, 1½-inch .....			
2	Buckles, roller, ¾-inch .....			
5	Buckles, roller, ¾-inch .....			
12	Buckles, roller, 1½-inch .....			
10	Buckles, wire, ¾-inch .....	In store .....		
2	Burners, lantern .....			
1	Cheek "D" .....			
1	Chamois skin .....			
4	Conway loops, ¾-inch .....			
3	Dressing, russet leather .....	In store .....		
4	End buckles .....			
2	Globes, lantern .....	do .....		

<sup>1</sup> No material will be drawn from this supply for making repairs and replacements except in sudden calls for field service if necessary to replace missing items of the regular supplies. To avoid deterioration, all perishable articles should be replaced by similar ones received with the regular 6 months' allowance.

## Statement of total equipment of one 3-inch gun battery—Continued.

No.	Article.	Where carried.	Property classification.				
			Class.	Section.			
<i>Reserve supplies for war service—Contd.</i>							
2	Hooks, back strap.....	In store.....	IV	8			
2	Hooks, collar strap.....						
3	Hooks, double, brass wire.....	In store.....	IX	1			
3	Hooks, end, brass wire.....	do.....	IX	5			
2	Leather, bridle, backs.....	In store.....	X	10			
2	Leather, collar, backs.....						
30	Leather, harness, pounds.....						
1	Leather, latigo, side.....	In store.....	IX	5			
3	Nails, saddle.....						
1	Oil, clock, ounce.....	In store.....	X	10			
4	Oil, coal, gallons.....						
4	Oil, hydroline, gallons.....						
12	Oil, lubricating, gallons.....						
16	Oil, neat's-foot, gallons.....						
2	Oil, slushing, light, gallons.....	In store.....	IX	5			
1	Oil, sperm, gallons.....						
3	Ornaments, brow band.....						
2	Rings, $\frac{3}{4}$ -inch diameter, saddle bag.....	In store.....	IV	8			
8	Rings, 1 $\frac{1}{2}$ -inch diameter, saddle.....						
4	Rings, 2-inch diameter, halter.....						
3	Rings, 4-inch diameter, cincha strap.....						
3	Rings, 4-inch diameter, quarter strap.....						
3	Rings "D," 1-inch diameter, feed bag.....	In store.....	X	10			
1	Rivets and burs, brass $\frac{1}{2}$ -inch, No. 10, pound.....						
1	Rivets and burs, brass $\frac{3}{8}$ -inch, No. 10, pound.....	In store.....	X	10			
18	Salsoda, pounds.....	In store.....	IX	1			
2	Snap hook, haversack, 1-inch.....						
3	Snap hook, feed bag.....	do.....	IV	8			
12	Squares, halter.....	do.....	IX	5			
40	Soap, castile, pounds.....	In store.....	X	10			
3	Soap, H. and H., cakes or "Paco".....						
60	Soap, saddle, Frank Miller's, pounds.....						
25	Sponges, 5-inch.....	In store.....	IV	8			
2	Strap loops, feed bag.....						
2	Studs, saddle bag.....	do.....	IX	5			
1	Tacks, copper, 12-ounce, paper.....	In store.....	X	10			
1	Tacks, copper, 20-ounce, paper.....						
1	Thread, carpet, No. 18, olive-drab, pound.....						
1	Thread, shoe, No. 3, brown, pound.....						
1	Thread, shoe, No. 10, brown, pound.....						
25	Waste, cotton, pounds.....						
1	Wax, stitching, brown, pound.....						
2	Wicks, lantern.....						
<i>Ammunition.</i>							
See general orders pertaining to annual allowance of ammunition.							





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## WAR DEPARTMENT,

## OFFICE OF THE CHIEF OF ORDNANCE,

*Washington, June 5, 1917.*

August 1, 1905.  
 Revised May 10, 1906.  
 Revised July 17, 1908.  
 Revised July 1, 1911.  
 Revised October 1, 1912.  
 Revised August 3, 1915.  
 Revised June 5, 1917.  
 FORM No. 1659.  
 Ed. June 5-17—3,000.













